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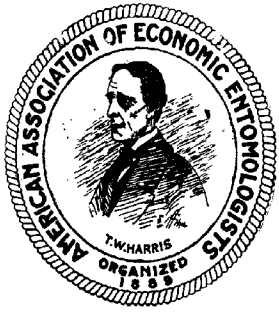

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[1] Withdrawn for publication elsewhere.

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LIST OF MEETINGS AND PAST OFFICERS

First Annual Meeting, Washington, D. C., Nov. 12–14, 1889. President C. V. Riley; First Vice-President, S. A. Forbes; Second Vice-President, A. J. Cook; Secretary, John B. Smith.

Second Annual Meeting, Champaign, Ill., Nov. 11–13, 1890. (The same officers had charge of this meeting.)

Third Annual Meeting, Washington, D. C., Aug. 17–18, 1891. President, James Fletcher; First Vice-President, F. H. Snow; Second Vice-President, Herbert Osborn; Secretary, L. O. Howard.

Fourth Annual Meeting, Rochester, N. Y., Aug. 15–16, 1892. President, J. A. Lintner; First Vice-President, S. A. Forbes; Second Vice-President, J. H. Comstock; Secretary, F. M. Webster.

Fifth Annual Meeting, Madison, Wis., Aug. 14–16, 1893. President, S. A. Forbes; First Vice-President, C. J. S. Bethune; Second Vice-President, John B. Smith; Secretary, H. Garman.

Sixth Annual Meeting, Brooklyn, N. Y., Aug. 14–15, 1894. President, L. O. Howard; First Vice-President, John B. Smith; Second Vice-President, F. L. Harvey; Secretary, C. P. Gillette.

Seventh Annual Meeting, Springfield, Mass., Aug. 27–28, 1895. President, John B. Smith; First Vice-President, C. H. Fernald; Secretary, C. L. Marlatt.

Eighth Annual Meeting, Buffalo, N. Y., Aug. 21–22, 1896. President, C. H. Fernald; First Vice-President, F. M. Webster; Second Vice-President, Herbert Osborn; Secretary, C. L. Marlatt.

Ninth Annual Meeting, Detroit, Mich., Aug. 12–13, 1897. President, F. M. Webster; First Vice-President, Herbert Osborn; Second Vice-President, Lawrence Bruner; Secretary, C. L. Marlatt.

Tenth Annual Meeting, Boston, Mass., Aug. 19–20, 1898. President, Herbert Osborn; First Vice-President, Lawrence Bruner; Second Vice-President, C. P. Gillette; Secretary, C. L. Marlatt.

Eleventh Annual Meeting, Columbus, Ohio. Aug. 18–19, 1899. President, C. L. Marlatt; First Vice-President, Lawrence Bruner; Second Vice-President, C. P. Gillette; Secretary, A. H. Kirkland.

Twelfth Annual Meeting, New York, N. Y., June 22–23, 1900. President, Lawrence Bruner; First Vice-President, C. P. Gillette; Second Vice-President, E. H. Forbush; Secretary, A. H. Kirkland.

Thirteenth Annual Meeting, Denver, Colo., Aug. 23–24, 1901. President, C. P. Gillette; First Vice-President, A. D. Hopkins; Second Vice-President, E. P. Felt; Secretary, A. L. Quaintance.

Fourteenth Annual Meeting, Pittsburgh, Pa., June 27–28, 1902. President, A. D. Hopkins; First Vice-President, E. P. Felt; Second Vice-President, T. D. A. Cockerell; Secretary, A. L. Quaintance.

Fifteenth Annual Meeting, Washington, D. C., Dec. 26–27, 1902. President, E. P. Felt; First Vice-President, W. H. Ashmead; Second Vice-President, Lawrence Bruner; Secretary, A. L. Quaintance.

Sixteenth Annual Meeting, St. Louis, Mo., Dec. 29–31, 1903. President, M. V. Slingerland; First Vice-President, C. M. Weed; Second Vice-President, Henry Skinner; Secretary, A. F. Burgess.

Seventeenth Annual Meeting, Philadelphia, Pa., Dec. 29–30, 1904. President, A. L. Quaintance; First Vice-President, A. F. Burgess; Second Vice-President, Mary E. Murtfeldt; Secretary, H. E. Summers.

Eighteenth Annual Meeting, New Orleans, La., Jan. 1–4, 1906. President, H. Garman; First Vice-President, E. D. Sanderson; Second Vice-President, F. L. Washburn; Secretary, H. E. Summers.

Nineteenth Annual Meeting, New York, N. Y., Dec. 28–29, 1906. President, A. H. Kirkland; First Vice-President, W. E. Britton; Second Vice-President, H. A. Morgan; Secretary, A. F. Burgess.

Twentieth Annual Meeting, Chicago, Ill., Dec. 27–28, 1907. President, H. A. Morgan; First Vice-President, H. E. Summers; Second Vice-President, W. D. Hunter; Secretary, A. F. Burgess.

Twenty-first Annual Meeting, Baltimore, Md., Dec. 28–29, 1908. President, S. A. Forbes; First Vice-President, W. E. Britton; Second Vice-President, E. D. Ball; Secretary, A. F. Burgess.

Twenty-second Annual Meeting, Boston, Mass., Dec. 28–29, 1909. President, W. E. Britton; First Vice-President, E. D. Ball; Second Vice-President, H. E. Summers; Secretary, A. F. Burgess.

Twenty-third Annual Meeting, Minneapolis, Minn., Dec. 28–29, 1910. President, E. D. Sanderson; First Vice-President, H. T. Fernald; Second Vice-President, P. J. Parrott; Secretary, A. F. Burgess.

Twenty-fourth Annual Meeting, Washington, D. C., Dec. 27–29, 1911. President, F. L. Washburn; First Vice-President, E. D. Ball; Second Vice-President, R. H. Pettit; Secretary, A. F. Burgess.

Twenty-fifth Annual Meeting, Cleveland, Ohio, Jan. 1–3, 1913. President, W. D. Hunter; First Vice-President, T. J. Headlee; Second Vice-President, R. A. Cooley; Secretary, A. F. Burgess.

Twenty-sixth Annual Meeting, Atlanta, Ga., Dec. 31, 1913–Jan. 2, 1914. President, P. J. Parrott; First Vice-President, E. L. Worsham; Second Vice-President, Wilmon Newell; Secretary, A. F. Burgess.

Twenty-seventh Annual Meeting, Philadelphia, Pa., Dec. 28–31, 1914. President H. T. Fernald; First Vice-President, Glenn W. Herrick; Second Vice-President, W. E. Britton; Third Vice-President, Wilmon Newell; Secretary, A. F. Burgess.

Special Meeting, Berkeley, Cal., Aug. 9–10, 1915. (Officers same as for Twenty eighth Annual Meeting.)

Twenty-eighth Annual Meeting, Columbus, Ohio, Dec. 27–30, 1915. President, Glenn W. Herrick; First Vice-President, R. A. Cooley; Second Vice-President W. E. Rumsey; Third Vice-President, E. F. Phillips; Secretary, A. F. Burgess.

Twenty-ninth Annual Meeting, New York, N. Y., Dec. 28–30, 1916. President, C. Gordon Hewitt; First Vice-President, G. A. Dean; Second Vice-President, E. D. Ball; Third Vice-President, W. J. Schoene; Fourth Vice-President, T. J. Headlee; Secretary, A. F. Burgess.

Thirtieth Annual Meeting, Pittsburgh, Pa., Dec. 31, 1917–Jan. 2, 1918. President, R. A. Cooley; First Vice-President, W. E. Hinds; Second Vice-President, A. W. Morrill; Third Vice-President, G. M. Bentley; Fourth Vice-President, B. N. Gates; Secretary, A. F. Burgess.

Thirty-first Annual Meeting, Baltimore, Md., Dec. 26–27, 1918. President, E. D. Ball; First Vice-President, W. C. O'Kane; Second Vice-President, G. P. Weldon; Third Vice-President, E. C. Cotton; Fourth Vice-President, Franklin Sherman, Jr.; Secretary, A. F. Burgess.

Thirty-second Annual Meeting, St. Louis, Mo., Dec. 31, 1919–Jan. 2, 1920. President, W. C. O'Kane; First Vice-President, A. G. Ruggles; Second Vice-President, H. J. Quayle; Third Vice-President, E. C. Cotton; Fourth Vice-President, W. E. Britton; Secretary, A. F. Burgess.

Thirty-third Annual Meeting, Chicago, Ill., Dec. 29–31, 1920. President, Wilmon Newell; First Vice-President, H. A. Gossard; Second Vice-President, E. M. Ehrhorn; Third Vice-President, J. G. Sanders; Fourth Vice-President, F. B. Paddock; Secretary, A. F. Burgess.

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Proceedings of the Thirty-Third Annual Meeting of the American Association of Economic Entomologists

The thirty-third annual meeting of the American Association of Economic Entomologists was held in Kent 20, University of Chicago, December 29 to 31, 1920.

The meeting was called to order by President Wilmon Newell, at 10.10 a. m., December 29. The annual reports and routine business of the opening session was transacted and two papers were presented at this session. At the afternoon session, the annual address of the President was delivered, which was followed by general discussion and program of interesting papers. On the same evening, the Section on Apiculture held its meeting, which was largely attended and was of unusual interest. Meetings of the general association were continued on Thursday morning, December 30, and in the afternoon the time was given over to the Section on Horticultural Inspection.

On Thursday evening, a dinner was held at the Sherman Hotel, at which one hundred entomologists were present. President Newell introduced Professor W. C. O'Kane to preside at the close of the dinner and representatives from most of the entomological societies in the United States and Canada were called upon to respond. This occasion was greatly enjoyed by all present.

On Friday morning, December 31st, a joint session was held with the American Phytopathological Society in Mandel Hall, University of Chicago.

The final session of the association with reading of papers and transaction of final business, was called to order at 1.30 p. m., Friday afternoon.

The business proceedings form Part I of this report, and the addresses, papers, and discussions Part II.

The proceedings of the Sections on Apiculture and Horticultural Inspection will be prepared by the sectional secretaries and published as a part of this report.

PART I. BUSINESS PROCEEDINGS

The meeting was called to order by President Newell, at 10.10 a. m., Wednesday, December 29, 1920. About 160 members and visitors attended the sessions. The following were present:

George G. Ainslie, R. R. 9, Knoxville, Tenn.
J. M. Aldrich, Washington, D. C.
R. H. Allen, Boston, Mass.
William J. Baerg, Fayetteville, Ark.
E. D. Ball, Ames, Iowa.
William Barnes, Decatur, Ill.
G. M. Bentley, Knoxville, Tenn.
S. W. Bilsing, College Station, Texas.
R. W. Braucher, Chicago, Ill.
W. H. Brittain, Truro, N. S.
Luther Brown, Gulfport, Miss.
C. T. Brues, Boston, Mass.
A. F. Burgess, Melrose Highlands, Mass.
William B. Cartwright, Centralia, Ill.
W. L. Chandler, East Lansing, Mich.
R. N. Chapman, Minneapolis, Minn.
E. C. Cotton, Columbus, Ohio.
J. J. Davis, LaFayette, Ind.
George A. Dean, Manhattan, Kan.
Dwight M. De Long, Harrisburg, Pa.
H. F. Dietz, Indianapolis, Ind.
Carl J. Drake, Syracuse, N. Y.
J. E. Dudley, Jr., Madison, Wis.
J. R. Eyer, State College, Pa.
H. L. Fackler, Knoxville, Tenn.
E. P. Felt, Albany, N. Y.
F. A. Fenton, Ames, Iowa.
C. K. Fisher, Wichita, Kan.
W. P. Flint, Urbana, Ill.
C. L. Fluke, Jr., Madison, Wis.
S. A. Forbes, Urbana, Ill.
Anson L. Ford, Brookings, S. D.
S. B. Fracker, Madison, Wis.
Arthur Gibson Ottawa Can.
H. A. Gossard, Wooster, Ohio.
J. E. Graf, Biloxi, Miss.
Samuel A. Graham, St. Paul, Minn.
Thomas L. Guyton, Harrisburg, Pa.
Charles H. Hadley, Jr., Riverton, N. J.
R. W. Harned, Agricultural College. Miss.
Albert Hartzell, Ames, Iowa.
Leonard Haseman, Columbia, Mo.
Kenneth Hawkins, Watertown, Wis.
T. J. Headlee, New Brunswick, N. J.
Glenn W. Herrick, Ithaca, N. Y.
W. E. Hinds, Auburn, Ala.
H. E. Hodgkiss, State College, Pa.
William E. Hoffmann, Lawrence, Kans.
J. R. Horton, Wichita, Kan.
J. S. Houser, Wooster, Ohio.
L. O. Howard, Washington, D. C.
S. J. Hunter, Lawrence, Kan.
H. E. Jaques, Mt. Pleasant, Iowa.
E. G. Kelly, Manhattan, Kan.
H. H. Kimball, Agricultural College, Miss.
H. H. Knight, St. Paul, Minn.
E. J. Kraus, Madison, Wis.
W. H. Larrimer, West LaFayette, Ind.
Stewart Lockwood, Agricultural College, N. D.
Q. S. Lowry, Canton, Mass.
S. Marcovitch, Knoxville, Tenn.
C. L. Marlatt, Washington, D. C.
J. W. McColloch, Manhattan, Kan.
A. L. Melander, Pullman, Wash.
C. L. Metcalf, Columbus, Ohio.
Z. P. Metcalf, West Raleigh, N. C.
J. H. Montgomery, Gainesville, Fla.
William Moore, St. Paul, Minn.
Henry Ness, Ames, Iowa.
Wilmon Newell, Gainesville, Fla.
F. M. O'Bryne, Gainesville, Fla.
W. C. O'Kane, Durham, N. H.
Herbert Osborn, Columbus, Ohio.
Raymond C. Osburn, Columbus, Ohio.

J. H. Pearmann, Davenport, Iowa.
F. B. Paddock, Ames, Iowa.
H. R. Painter, West LaFayette, Ind.
Wallace Park, Ames, Iowa.
T. H. Parks, Columbus, Ohio.
P. J. Parrott, Geneva, N. Y.
N. L. Partridge, E. Lansing, Mich.
L. M. Peairs, Morgantown, W. Va.
G. W. Peake, St. Paul, Minn.
F. C. Pellett, Hamilton, Ill.
Alvah Peterson, New Brunswick, N. J.
C. H. Popenoe, Washington, D. C.
A. L. Quaintance, Washington, D. C.
E. R. Root, Medina, Ohio.
A. H. Rosenfeld, Tucuman, Argentina.
O. W. Rosewall, Baton Rouge, La.
A. G. Ruggles, St. Paul, Minn.
V. I. Safro, Louisville, Ky.
J. G. Sanders, Harrisburg, Pa.
E. R. Sasscer, Washington, D. C.
A. F. Satterthwait, Webster Groves, Mo.
H. C. Severin, Brookings, S. D.
V. E. Shelford, Urbana, Ill.
F. L. Simanton, Benton Harbor, Mich.
M. P. Somes, Clinton, Miss.
Frank Stirling, Gainesville, Fla.
K. C. Sullivan, Columbia, Mo.
J. M. Swaine, Ottawa, Can.
M. H. Swenk, Lincoln, Neb.
O. H. Swezey, Honolulu, H. T.
L. R. Taft, East Lansing, Mich.
M. C. Tanquary, College Station, Tex.
E. P. Taylor, Tucson, Ariz.
C. F. Turner, Schenectady, N. Y.
L. B. Uichanco, Forest Hills, Mass.
F. M. Wadley, Rockford, Ill.
Claude Wakeland, Boise, Idaho.
F. N. Wallace, Indianapolis, Ind.
W. R. Walton, Washington, D. C.
R. L. Webster, Ithaca, N. Y.
W. M. Wheeler, Boston, Mass.
R. D. Whitmarsh, Milwaukee, Wis.
H. F. Wilson, Madison, Wis.
H. Yuasa, Chicago, Ill.

PRESIDENT WILMON NEWELL: The meeting will please come to order. We will now hear the report of the Secretary.

REPORT OF THE SECRETARY

At the St. Louis meeting, the total membership of the association was 566, as follows: Active, 216; associate, 303; foreign, 47. At that meeting 51 associate members were elected and one re-instated, and 31 were transferred from the associate to the active roll. Two associate members resigned during the year, and three active and nine associate members have been dropped for non-payment of dues. Two associate members have been dropped, they having paid no dues since being elected to membership, and two active members have died during the year. Three foreign members were elected and three were reported as having died.

The present membership is 242 actives, 311 associate, and 47 foreign, making a total of 600, a net gain of 34 for the year.

Early in March the members of the association were shocked to learn of the sudden death on February 29 of Dr. C. Gordon Hewitt, Entomologist of the Dominion of Canada. He was a past president of the association and since the time of his appointment as Dominion Entomologist, had been a regular attendant at the annual meetings. His pleasing personality as well as his ability and zeal as an entomologist, had endeared him to all his co-workers in entomology. While his loss to those on this side of the border is most keenly felt, the loss to Canada is much more severe. During the time he held the office of Dominion Entomologist, it continually increased in influence and prestige. The scope of the work was broadened and the foundation laid for increased development of the entomological field throughout the Dominion. No greater word can be said of any man when he lays down the duties of his office than that his work has been well done. As entomologists we are proud of his splendid achievements wrought through a few short years.

Professor W. R. McConnell died on June 23 at Carlisle, Pa. He was an active member of the association and greatly admired and respected by those who were

fortunate enough to know him. From a Professorship at the Pennsylvania State College, he accepted an appointment with the Bureau of Entomology, specializing on cereal and forage insects, particularly on the parasites of some of the most destructive pests.

He was a hard and conscientious worker and was conducting investigations of great promise, and it was with deep regret that the association was called upon to mourn his loss.

The death of three foreign members has been reported to the Secretary during the year.

Fred Enock died in July, 1916, at London, England; Richard Helms, North Sydney, New South Wales, and N. Kourdumoff, Opytnoe Pole, Poltava, Russia. The exact date of the death of the last two is not definitely known. Mr. Kourdumoff visited this country some years ago and proved to be a young man of great promise. After his return to Russia, he acted for several years as a collaborator of the Bureau of Entomology and endeavored to secure information that might be of value to this country concerning the gipsy moth and other insects. He extended every aid possible in this respect and enjoyed the friendship and confidence of all American entomologists who knew him. He was said to have died while serving in the Russian Army.

The Pacific Slope Branch held its annual meeting June 17–19, 1920, at Seattle, Washington. It was well attended and many papers of interest were presented.

At the last annual meeting the association voted to discontinue the use of numbered buttons. Since that time, a number of members, particularly those who do not attend the meetings frequently and have not become well acquainted, have strongly urged that some means of identification be adopted at the meeting to enable new members to get in touch promptly with others whom they wish to meet. As a result of this sentiment and by direction of the executive committee, the Secretary is furnishing name tags to be used in the coat lapel of members at the Chicago meeting.

JOURNAL OF ECONOMIC ENTOMOLOGY

During the past year, the cost of printing the JOURNAL has advanced 25 per cent. over the figures for the preceding years. By strict economy and by holding the number of printed pages at about the same number as for the past two years, it has been possible to carry through the publication without increasing the subscription price. This could not have been done from receipts from subscriptions alone, and there would have been a slight deficit if a large number of back numbers and used cuts had not been sold. These sales amounted to $394.65, and this has enabled the JOURNAL to finish the year with approximately the same balance as at this time last year.

Our present publishers state that they have printed the JOURNAL at a financial loss during the past year, and that beginning January 1st, it will be necessary to increase the price of printing 50 per cent. Efforts are being made to secure better rates for printing, as it is evident that the same number of pages cannot be published next year at these rates without serious loss to the association. It is evident under these conditions that an increase of at least $1.50 per volume on the JOURNAL, based on our present subscription lists, would be necessary in order to meet the increased cost, and this change of rate cannot be made before January 1st, 1922. Unless some means can be found of reducing the cost of printing very materially, it will be necessary to reduce the size of the publication or find additional funds to finance it during the coming year. For the information of our members the following table is submitted, showing the number of active and associate members of the association, circulation of the JOURNAL, number of pages printed, average cost per page which

includes part of the expense for mailing, and balance in the JOURNAL fund after deducting loans, from 1915 to 1920 inclusive

Year	Members	Circulation	Pages	Cost Per Page	Balance	Loan
	Active and Associate					
1915	402	764	566	$2.24	$755.02	
1916	416	753	580	2.62	646.87	
1917	451	772	572	3.24	189.27	
1918	507	757	494	3.40	-105.89	$200.00
1919	519	851	478	3.65	83.23	310.00
1920	562	844	488	4.79	385.10	

The Journal is indebted to the association for funds advanced, $350.00.

In 1920, 42 active and associate members and 41 foreign members did not subscribe to the JOURNAL. Since 1915, the cost of publishing the JOURNAL has increased from $2.24 to $4.79 per net page, amounting to 114 per cent. Until January 1st, 1920, no increase in subscription rates was made, but on that date, $1.00 per volume was added to the rate. This is an increase of 66⅔ per cent. for members, and 40 per cent. for non-members. The increase in costs of production has been taken up by decreasing the size of the JOURNAL and by borrowing funds from the association and by loan of $60 by members at the Baltimore meeting, which has been credited to their subscription accounts and is gradually being paid back in that way. With the increase in membership of the association, the pressure for publishing articles by the members has greatly increased. This has been intensified during the past year on account of the extreme difficulty in inducing local, state, or Federal institutions to publish the results of many investigations that have been carried on.

Suggestions have been received that the stenographic report of the annual meeting be dispensed with and that no discussions be printed in the JOURNAL. On the basis of the report for 1920, about 30 pages of printed matter would be eliminated by following this plan. The elimination from the February issue of the JOURNAL of the organization, list of meetings and members, would also save considerable expense.

The judgment of the members is desired as to their wishes in this respect.

INDEX TO THE LITERATURE OF AMERICAN ECONOMIC ENTOMOLOGY I

During the past year, a considerable number of copies of this Index have been sold, and it has been possible to return to the association treasury $100 which clears up the indebtedness of the Index to the association. A small balance remains in the treasury and there are now on hand 231 bound and 400 unbound copies which are available for sale.

It is deemed advisable to increase the price of this Index to $6.00 a copy so as to make it uniform with the sale price of the new Index, which is about to be issued. These prices are to be effective January 1. It is recommended that all funds not needed for postage, insurance, etc., in connection with Index I, be transferred to the fund that is being used for publishing Index II.

INDEX TO LITERATURE OF AMERICAN ECONOMIC ENTOMOLOGY II

At the last annual meeting, the association voted that the editorial board of the JOURNAL OF ECONOMIC ENTOMOLOGY should take charge of the publication of Index II.

The manuscript for this Index was prepared by Miss Mabel Colcord, Librarian of the U. S. Bureau of Entomology, and numerous assistants and experts in that Bureau. The financial arrangements relative to publishing the Index were left to the Secretary and the editorial work to the Editor of the JOURNAL. Estimates

secured in the early spring indicated that the price of publication would far exceed the amount of the estimates made in the report submitted at the last annual meeting. This was due to the increased cost of printing and because the number of pages greatly exceeded the estimates. It was not until June that figures were received from any publisher that were low enough to warrant the association in attempting to finance this publication.

Immediately following the receipt of bids that seemed to be within our means, circulars were sent to all members of the association, asking for advance prepaid subscriptions at the rate of $5.00 per copy. The response was rather meagre and a second request was made in July which brought slightly better results. Conditions were such at the time that it was evident that the association could not hope to publish this book without securing financial aid, and with the approval of the editorial board, the executive committee and the committee on policy were asked to authorize the association to borrow $1500 to finance the publication. This request was made August 13, but final action was not secured from these two committees until October.

In order to neglect no possible opportunity for having this book published, the editor made request that it be issued by the U. S. Department of Agriculture. Owing to the conditions of the publication fund and the nature of the matter to be published, it was impossible for the Department to undertake the work, and your Secretary immediately endeavored to raise the necessary money to publish the Index by soliciting loans of $25 or more from various members.

On this date, December 1, 1920, 145 members have subscribed and paid for 161 copies of the Colcord Index, and 29 loans of $25 each have been secured from 26 members. In addition to this, 58 orders for this Index have been received that cannot be paid for until the book has been delivered. In anticipation that whatever additional funds are necessary can be raised during the meeting, the contract for printing has been awarded and the Index should be ready for mailing in February.

ASSOCIATION STATEMENT

Balance in Treasury, December 8, 1919		$ 803.48
By amount received from dues, 1920		610.50
By amount received from interest in Malden National Bank		22.49
By amount received from interest, Melrose Savings Bank		7.81
By amount received from interest $100 Liberty Bond		4.25
By amount received from Index I fund		100.00
By amount received from JOURNAL fund		100.00
Paid stenographic report of 1919 meeting	$ 91.58	
Buttons, 1919 meeting	11.24	
Postage	67.86	
Printing programs, etc	111.76	
Stationery	59.65	
Tags	3.50	
Discount on checks	5.50	
Returned check	3.50	
Telegraph and express	12.80	
Expenses of Committee on National Museum (Postage)	5.74	
Expenses of Pacific Slope Branch	8.91	
Clerical work, Secretary's office	40.00	
One-half salary of Secretary	50.00	
	$ 472.04	
Balance, December 1, 1920	1,176.49	
	$1,648.53	$1,648.53

Balance deposited as follows:		
Melrose Savings Bank	$ 179.83	
Malden National Bank	996.66	

JOURNAL STATEMENT

Balance in Treasury, December 8, 1919		$ 393.32
By amount received from subscriptions, advertising, etc		2,943.99
By amount received from Malden National Bank (interest)		15.04
Paid for postage	$ 79.40	
Paid for insurance	17.00	
Paid for printing	2,335.45	
Paid for half-tones	125.23	
Return on subscriptions	9.12	
Exchange on checks	17.05	
Returned checks	9.00	
Transfer to Association fund	100.00	
Salary, Editor	100.00	
Clerical work, Editor's office	75.00	
One-half salary of Secretary	50.00	
Clerical work, Secretary's office	50.00	
	$2,967.25	
Balance, December 1, 1920	385.10	
	$3,352.35	$3,352.35
Balance deposited in Malden, Mass., National Bank	$ 385.10	
The JOURNAL owes the Association account		$ 350.00

INDEX I STATEMENT

Balance in Treasury, December 8, 1919		$ 25.72
By amount received from sales to December 1, 1920		182.45
By amount received from Index II postage (advanced)		22.50
By amount received from Index II Printing (advanced)		5.50
Paid for Printing	$ 5.50	
Paid for Postage	38.83	
Paid for insurance	17.00	
Transfer to Association fund	100.00	
	$ 161.33	
Balance, December 1, 1920	74.84	
	$ 236.17	$ 236.17
Balance deposited in Malden, Mass., National Bank	$ 74.84	

INDEX II STATEMENT

Received from advance subscriptions		$ 807.50
Paid for printing and postage	$ 31.00	
Paid for express	.35	
Paid for returned checks	10.00	
	$ 41.35	
Balance, December 1, 1920	766.15	
	$ 807.50	$807.50
Deposited in Malden, Mass., National Bank	$ 766.15	

SUMMARY

Balance on Index I account	$ 74.84
Balance on Index II account	766.15
Balance on JOURNAL account	385.10
Balance on association account	1,176.49
One 4¼ per cent. Liberty Bond	100.00
	$2,502.58

RECOMMENDATIONS

It is recommended that all but a small balance for mailing that remains in the Index I fund be transferred to the Index II fund; that not to exceed $700 be transferred from the association fund to the Index II fund—this amount to be repaid as soon as sales of this book furnish the necessary funds; that the Editorial Board "of the JOURNAL" be authorized to increase the price beginning January 1st, 1922, if conditions during the first half of the coming year make such an increase necessary; that the association take definite action concerning the approximate number of pages that should be published annually in the JOURNAL, and if it is desired to keep the JOURNAL at its present size, some adequate means be found to meet the cost during the coming year.

Respectfully submitted,
A. F. BURGESS, *Secretary*

Voted that the recommendations in the report be referred to the executive committee and that the financial part of the report be referred to the auditing committee.

PRESIDENT WILMON NEWELL: I will now read the report of the Executive Committee.

REPORT OF THE EXECUTIVE COMMITTEE

The Executive Committee has not been able to meet during the year but has considered and passed upon a number of matters by correspondence.

FINANCIAL SUPPORT OF IMPORTANT PROJECTS

During the early part of the year there appeared serious danger of appropriations for a number of important lines of entomological work, including the gipsy moth, European corn borer and pink bollworm projects, being severely reduced and to such an extent as to incur serious risk of these pests getting entirely beyond control. This situation was called to the attention of a number of our active members by your President, with the result that information bearing on these projects and their respective merits was placed in the hands of members of Congress. The amounts for the various lines of entomological work were in most instances restored to the figures requested by the Bureau of Entomology. In this connection it should be said that Chairman O'Kane, of the Committee on Policy, did efficient work in Washington in behalf of appropriations for entomological projects, most of which are national in scope.

COMMITTEE ON ENTOMOLOGY, NATIONAL RESEARCH COUNCIL

Early in the year the National Research Council decided to appoint, as its Committee on Entomology, Division of Biology and Agriculture, the members of this

Association's Committee on Policy, with one member at large. To fill the latter position your President, with approval of the Executive Committee, appointed Dr. A. L. Quaintance of the Bureau of Entomology.

Crop Protection Institute

At a conference of insecticide manufacturers, plant pathologists and entomologists, arranged for by the National Research Council and held at Rochester, New York, June 23, our Association was represented by Messrs. W. C. O'Kane, P. J. Parrott, E. P. Felt and J. G. Sanders. At this conference preliminary plans were made for the formation of the "Crop Protection Institute". Organization of the Institute was perfected at a meeting held in Washington September 28th, attended by the President and several members of our Committee on Policy, as well as other members of our association, representatives of the American Phytopathological Society and of the manufacturers of insecticides and spraying machinery. The constitution adopted by the Plant Protection Institute provided for a board of trustees composed of 13 members, consisting of three representatives from the American Association of Economic Entomologists, three from the American Phytopathological Society, two from the Association of Official Agricultural Chemists, one from the National Research Council, three from the Manufacturers of Insecticides and Fungicides and one from the Manufacturers of Allied Lines. As representatives of our Association, to serve in this capacity until the next annual meeting, your President appointed Messrs. P. J. Parrott, J. G. Sanders and W. C. O'Kane. These appointments were approved by the Executive Committee.

Regional Branches

The Executive Committee has given careful thought to the question of encouraging the establishment of regional branches of our Association. On this question, which is essentially one of policy, the members of the Committee have held somewhat diverse opinions and as it is evidently a matter of keen interest to the entire membership the Executive Committee has taken no action on it. Further reference to this question will doubtless be contained in the report of the Committee on Policy.

Extension

On February 18th your President, at the suggestion of the Subcommittee on Organization and with the approval of the Executive Committee, appointed Dr. L. O. Howard as representative of our Association to investigate the feasibility of encouraging the formation of an association of economic entomologists in Europe, with a possible view to the ultimate organization of an international association. Dr. Howard discharged in a highly satisfactory manner the task entrusted to him and has submitted a rather full report on this question to the Committeee on Policy.

Index to Economic Entomology

In October the Executive Committee gave its approval to the borrowing of $1,500 for the purpose of financing the new Index to Economic Entomology, it appearing from the information at hand that this amount would easily be repaid by proceeds from the sale of the index but that the actual publication could not be handled without this amount of actual cash being available.

Identification Buttons at Annual Meetings

At our last annual meeting the Association voted to dispense with the use of numbered identification buttons at our annual meetings. It is the opinion of your

Executive Committee that this action was somewhat hasty and was taken without the members having given thoughtful consideration to the advantages derived from any method whereby the members of our Association quickly become acquainted and thereby derive the maximum of benefit from our meetings. The Committee therefore recommends that the custom of having numbered buttons, with a corresponding list of the members for reference, be renewed or that some plan, accomplishing the same purpose, be approved of by the Association.

WILMON NEWELL,
H. A. GOSSARD,
E. M. EHRHORN,
J. G. SANDERS,
F. B. PADDOCK,
A. F. BURGESS,
Executive Committee

By vote of the association the report was accepted and the recommendations adopted.

PRESIDENT WILMON NEWELL: The next is the report of the committee on policy.

This report was read by the chairman, Mr. W. C. O'Kane, and by vote of the association, was made the special order of business at 11 a. m., the following day. It was voted to have mimeographed copies made of the recommendations contained in this report for the use of members.

PRESIDENT WILMON NEWELL: The report of the Representative to the National Research Council will be given by Mr. P. J. Parrott.

REPORT OF REPRESENTATIVE TO THE NATIONAL RESEARCH COUNCIL

As the representative of the American Association of Economic Entomologists, I have attended all meetings of the Division of Biology and Agriculture of the National Research Council except one, which was held at the time of an extended visit to the Pacific Coast states.

In accordance with instructions, the Committee of Policy of the Association, with one member at large, was designated as the Committee of Entomology of the Division of Biology and Agriculture. Dr. A. L. Quaintance was subsequently appointed as the member at large, which insures a resident representative at Washington.

The resolution regarding entomological collections in the National Museum was adopted, and assistance offered.

There was also brought to the attention of the Division, the instructions of the Committee of Policy, for a conference with representatives of several chemical companies, to consider financial support for research and experimentation. Dr. Howe, Chairman of the Division of Research Extension, was authorized to cooperate with committees appointed by the entomologists and phytopathologists and to represent the Council in negotiations with the industrial concerns. Subsequent activities on this project, which finally culminated in the establishment of the Crop Protection Institute, have been mentioned in the JOURNAL OF ECONOMIC ENTOMOLOGY, and reported with considerable detail in circulars distributed by the National Research Council and the Crop Protection Institute.

At the election of officers at the May meeting of the Division, your representative was elected a member of the executive committee for the current year.

At a conference, held in Albany, N. Y., on April 19 there was submitted for consideration by the Committee of Policy two investigational projects as follows: 1, Suggested Plan for Investigation of Permanent Pasture and Meadow by Dr. Herbert Osborn; and 2, Investigation of Forest Insects by Dr. W. A. Riley. Both problems were heartily commended; but, it was deemed unwise to refer them at this time to the Council for approval as no funds were available to support the investigations.

The National Research Council is primarily a congress of the scientists of the country, and its organization is largely based on the national scientific societies. Projects are carried on by men who come in contact with the Council someway or other through the various scientific organizations. As regards financial support, the endowment provides for funds for administrative purposes and does not allow large sums of money for specific pieces of research. At the present time, it is largely the task of the societies to secure funds for their individual projects. The establishment of this policy, together with the successful efforts of various groups of workers in securing financial support for their specific undertakings, were the chief factors, that prompted the organization of the Crop Protection Institute.

While funds have not yet been obtained for the support of the foregoing projects, only good can develop from efforts that focus attention on them. Constant emphasis of promising problems should eventually lead to constructive activities, whereas if these are left to the accidents of individual initiative, action may be indefinitely postponed.

The Research Council serves a most useful function in promoting cooperation, coordination and correlation of scientific efforts and in encouraging collective action by the different societies of a kind not heretofore generally attempted by individuals or by private and public institutions. Through its assistance the Committee of Entomology can render important service in encouraging research in the field of entomology. With adequate financial support, it should also be able to conduct large cooperative activities among entomologists, having as their object field demonstration of scientific results and standardization of control measures, which are applicable to large geographical areas; efforts that receive little encouragement or financial aid from existing institutions. There also exists a large opportunity for enlisting the support of men of affairs, who can assist in coordinating civilian enterprises with entomological activities and shaping public sentiment in its judgment of the character and efficiency of entomological efforts in behalf of national welfare. Industrial concerns, individually and collectively, are prepared to grant funds for the investigation of special practical problems. Conferences between entomologists and representatives of industrial enterprises afford also opportunity for the exchange of ideas and advantageous consultation, which should result in the speeding up of research and experimental activities on problems of outstanding importance. Careful consideration needs to be given to the fundamental principles involved in these undertakings, and to the development of detailed plans, which will insure efficient direction of the approved projects.

There is a manifest need for greater unification of efforts, that the agricultural industry may feel the force of our work in solid impact, not singly at special points here and there but along the whole front. Entomologists have exceptional opportunities to develop a demonstration of whole-hearted cooperation in tasks related to the welfare of agriculture. Discerning workers will surely not fail to lend their support in fostering mutual confidence and good will in cooperative effort, which will make the Association a more productive servant of the country.

In conclusion, I wish to acknowledge my deep appreciation of the honor of representing the Association in the Division of Biology and Agriculture of the Council This institution is only in its infancy; and much preliminary spade-work has of necessity had to be done. Many tasks have yet to be tackled, which are destined to yield results of great interest and value when far-seeing men apply their minds to the task.

Respectfully submitted,

PERCIVAL J. PARROTT

Action on this report was deferred so that it could be considered with the report of the committee on policy.

PRESIDENT WILMON NEWELL: The report of the committee on nomenclature will be presented by Mr. Z. P. Metcalf.

REPORT OF THE COMMITTEE ON NOMENCLATURE

In accordance with the instructions of the Association at the St. Louis meeting, this committee has prepared for publication the list of all the common names of insects which have been passed upon and accepted by the Association up to and including the St. Louis meeting.

It is the sentiment of the committee, however, that, since the list as it stands is evidently in need of editorial revision for uniformity in use of hyphens as well as in certain other particulars, it would be unfortunate to have the list reprinted without further consideration by the Association. The present committee has not felt that editing the list in such a way as to change the words as recommended by previous committees and already accepted by the vote of the Association would come within its province.

With reference to the perplexities which the present committee have experienced, the three following may be cited by way of example:

1. We seem to be without guidance as to rules to word formation, in view of the fact that the Association has by committee recommendation and by vote accepted "Colorado potato-beetle" (with hyphen) and "Colorado pine beetle" (without hypen); "Locust-borer" and "Poplar borer"; "Beet leaf-hopper" and "Saddled leafhopper"; "Army-worm" and "Fall armyworm", etc., etc., etc.

2. The question as to whether names sanctioned should be equally applicable in all parts of the country seems to merit consideration. At present the Southern entomologists are asked to use "fall armyworm" for an insect injurious in May and "fall web-worm" for an insect whose larva becomes full fed in June.

3. The question of name length is perhaps also in need of consideration.

In view of the difficulties which have seemed to balk the progress of this work the committee recommends that the matter of nomenclature be assigned to a committee who will continue until a list of say 1000 names be completed. It would of course be understood that such a committee should not be under pressure of haste and that they should consult by correspondence or otherwise with many of the members to get their views on the adoption of certain names.

Respectfully submitted,

EDITH M. PATCH
Z. P. METCALF
ARTHUR GIBSON
Committee

Voted that the report be accepted, and the recommendations adopted. It is understood that this committee should continue as a permanent committee until the work on common names of insects is completed.

PRESIDENT WILMON NEWELL: The report of the committee on Index of Economic Entomology will be given by Mr. E. P. Felt.

REPORT OF THE COMMITTEE ON THE PUBLICATION OF THE INDEX OF AMERICAN ECONOMIC ENTOMOLOGY

Your Committee would report the completion early in the year of the manuscript for the years 1915 to 1919 inclusive. It would state that it has been turned over to the editorial board of the JOURNAL OF ECONOMIC ENTOMOLOGY in accordance with the action of the last annual meeting.

The committee would also voice its hearty approval of the liberal policy pursued by Dr. L. O. Howard, Chief of the Bureau of Entomology, in authorizing the preparation of this index.

This Committee further wishes to place on record its grateful appreciation of the earnest and accurate work of Miss Mabel Colcord, in charge of the project, and her associates. They have rendered invaluable services to economic entomologists not only of this country but of the world. It is difficult for one unfamiliar with work of this character to appreciate the amount of labor involved and it is therefore recommended that a special vote of thanks be given Miss Colcord and those who assisted in preparing the index as a slight recognition of their part in a laborious and usually somewhat thankless task.

It should be noted that the indebtedness incurred in the publication of the Bank's Index has been liquidated and a similar outcome is anticipated in the case of the Colcord Index.

Extended indices to the voluminous and scattered records of economic entomology are of immense service to all economic workers. Although the publication of the Colcord index was more expensive than was anticipated, the Committee believes that such aids are worth all that they cost and in spite of abnormally high prices now current, it is our opinion that future probabilities should be taken into account and with these in view, it is recommended that the Committee be continued and directed to carefully study the situation in order to ascertain possibilities for more frequent publication of such indices, either by this Association or through some other agency.

Respectfully submitted,

E. P. FELT
A. F. BURGESS
W. C. O'KANE
W. E. BRITTON
W. E. HINDS
Committee

Voted that the report of the committee be adopted.

PRESIDENT WILMON NEWELL: I will appoint the following committees:

Auditing committee: W. R. Walton, J. W. McColloch.

Resolutions committee: A. G. Ruggles, Arthur Gibson and M. C. Tanquary.

Nominations committee: J. J. Davis, C. L. Metcalf and J. E. Graf.

Is there any miscellaneous business?

MR. W. E. HINDS: I would like to make a statement concerning the Entomologists Employment Bureau.

ENTOMOLOGISTS EMPLOYMENT BUREAU

STATEMENT RELATIVE TO WORK OF 1920 AND PRESENT STATUS

By W. E. HINDS

At the annual meeting of the Association of Economic Entomologists in December 1919, it was voted first, in effect, to continue the Employment Bureau. Later, through the adoption of a resolution presented by the Committee on Resolutions action was taken to discontinue the Bureau. In view of the uncertainty as to the actual desire and purpose of the Association, and in consideration of the fact that the Association was under no financial obligation whatever in the matter as the report showed a small balance in the treasury at the time, and in view also of the fact that at the time this action was taken numerous references were in process of being completed, the work was continued upon the personal responsibility of the one who had been in charge of it for a number of years. The work was continued in the belief that there would be no objection on the part of the Association to such service being given as might be given under the circumstances but with the purpose to close up the work of the Bureau during the year in accordance with the second action of the last meeting.

During the year several enrollments were offered and in most, I believe in all, cases these were declined. However two or possibly three checks were at hand and awaiting return to the applicants when, unfortunately, the entire records of the Bureau were destroyed by fire in the burning of the Agricultural Building at Auburn on October 17, 1920. Thus were lost all enrollment records of some sixty or seventy men and all record of references given and of the financial work of the Bureau.

There seems therefore to be no possibility at this time of checking up the work of the Bureau with any degree of accuracy. The writers of uncashed checks will, of course, discover that fact in time through the failure of their banks to return the checks, but it is utterly impossible for us either to list the names of those enrolled or to tell how many references have been given to those whose names might be recalled.

As the members of the Association doubtless know, the work of the Bureau has been carried on for many years entirely as a disinterested and non-profit making service to all interested entomologists, both employers and employees. The balance of cash on hand a year ago was $58.93 according to the printed report in the JOURNAL OF ECONOMIC ENTOMOLOGY. The expense from Dec. 24, 1919 to May 15, 1920 is definitely known and is as stated below in the financial statement. The work of the balance of the year is estimated to have been equal to that for the first five months and payments for stenographic service, etc., have been made accordingly.

Under the circumstances no new enrollments will be received and no further references can be given. We would ask the Association to decide what disposition shall be made of the balance of cash on hand, as shown in the following statement.

FINANCIAL STATEMENT, FOR 1920

Balance of cash on hand, Dec. 24, 1919	$58.93
Receipts during the year 1920 (none)	00.00
Total receipts for 1920	$58.93
Disbursements:	
By stenographic service, Dec. 24, 1919 to May 15, 1920, total of 140 letters at 10 cents (V. 1)	$14.00
By stenographic service, May 15 to Dec. 31, 1920 (estimated correspondence 140 letters, (Voucher No. 2)	$14.00
By postage paid, 280 letters (Voucher No. 3)	5.60
By envelopes (Voucher No. 4)	3.00
Total	$36.60
Balance cash on hand, Dec. 27, 1920 (check to cover)	22.33
	$58.93

Respectfully submitted,

W. E. HINDS,
In Charge

Voted that the report be accepted; that Dr. Hinds be cordially thanked; that the financial part be referred to the auditing committee, and that the balance on hand be turned into the treasury of the association with the understanding that any members who have claims on that balance for unfulfilled obligations, may be re-imbursed on the proper presentation of these claims to the Secretary of the association.

MR. W. E. HINDS: I would like to make a brief statement in regard to the occurrence of the Mexican Bean Beetle in the Southern states.

This insect has become established in the vicinity of Birmingham, Ala., the first information as to serious injury being reported about the first of July, 1920. Work has been carried on to determine the distribution and possible spread of the species in the Eastern United States by the southern entomologists and the matter has been considered by the Federal Horticultural Board.

The establishment of this insect seems to be a serious national entomological problem. It has taken on new food plants and has more generations in the South than in the West. Apparently it will spread throughout the eastern United States wherever beans, cowpeas, and soy beans are grown in large quantities. These crops are of fundamental importance for food, forage, and for the renewal of soil fertility.

The legislature of the State of Alabama was in special session in September and was asked to appropriate $250,000 as a start toward a campaign for exterminating the pest in the eastern part of the country. The bill failed to receive a two-thirds vote in the legislature, this being

necessary to enact such a law at a special session. We are therefore without resources so far as the state of Alabama is concerned.

The Bureau of Entomology and the Federal Horticultural Board have been so impressed with the importance of the problem that a supplemental item, amounting to $150,000, has been added to the Agricultural Appropriation Bill to meet the emergency. This is to be expended for control, quarantine, and experimental work. I hope the members of this association will use all the influence possible in this emergency and I believe it will be helpful if many of the members will take this matter up favorably with Congressmen who are on the agricultural committee and urge them to support this item.

MR. Z. P. METCALF presented a statement as a member of the committee on the preservation of natural resources of the Ecological Society of America, covering the preservation of wild life, and stated that it was the belief of the committee that all organizations interested in natural history should support this committee.

The matter was referred to the committee on resolutions for later report.

On Thursday morning at 11 a. m., the report of the committee on policy was taken up for consideration. Each recommendation was read separately and after a number of amendments had been made, the report was adopted as follows:

REPORT OF THE COMMITTEE ON POLICY

ORGANIZATION

The Committee on Policy organized for the year 1920 with the following subcommittees:

Education, Dr. Osborn, chairman, Dr. Ball and Mr. Burgess.
Insect Control, Dr. Felt, chairman, Mr. Sanders and Prof. O'Kane.
Organization, Mr. Sanders, chairman, Prof. O'Kane, and Mr. Newell.
Research, Dr. Ball, chairman, Mr. Parrott and Dr. Osborn.
Publications, Mr. Burgess, chairman, Dr. Felt and Mr. Pierce.

COOPERATION WITH EUROPEAN ENTOMOLOGISTS

Early in the year the committee, acting with the officers of the Association, proposed to Dr. L. O. Howard that he approach European entomologists on the occasion of his visit to Europe in the early summer, to ascertain the possibilities in the way of forming, in Europe, an Association of Economic Entomologists along the same lines as our Association in this country. This commission was accepted by Dr. Howard. In conference with European entomologists, however, he found that conditions were not favorable at the present time for carrying out the project, partly because of the after-effects of the war, partly because of the lack of a common language and for other reasons.

Dr. Howard's report is as follows:

On February 14th, last, you wrote me, in your capacity as Chairman of the Committee on Policy of the American Association of Economic Entomologists, formally transmitting through me to European Entomologists the greetings of the A. A. E. E. and the adherence of the Committee on Policy to the proposal that there should be formed an European association of Economic Entomologists.

My report on this matter has been delayed from a misunderstanding, since it first appeared to me that I was to make a report direct to the Association. I see now that I should report to your Committee.

I endeavored to fulfill my commission in a satisfactory way and talked with a number of prominent economic entomologists during my visit abroad in England, France, Italy and Brussels. All of the men consulted were inclined to think that, while the idea might seem feasible enough to men in the United States, and that while theoretically it would be a very good scheme, there are nevertheless so many practical obstacles that the idea cannot be considered at the present time.

The initial difficulty is the one of language. Each country, moreover, has to a great extent its own problems. The financial condition of Europe at present is such as to be extremely unfavorable towards any international institution which requires the payment of dues. Moreover, the allies wish to have nothing to do with the Germanic countries. The exchange of publications between the different countries is already very intimate, and there seems to be no necessity whatever for the founding of an organ of publication like the JOURNAL OF ECONOMIC ENTOMOLOGY.

Other lesser matters were brought out in the course of my conferences, such as the striking disagreement between the two schools of economic entomologists in Italy, and other more or less temporary matters which interfere at present but which may not last for many years. The French entomologists are already on terms of intimate cooperation with the Italian men, but desire closer cooperation with the Imperial Bureau of Entomology of Great Britain.

The general opinion, however, was unanimous, and I myself agree with the soundness of the general conclusion. I recommend that the Committee wait for a more favorable time when the suggestion may be renewed.

FEDERAL APPROPRIATIONS

In the last week of February members of the Committee took part in a conference in Washington relative to Federal appropriations for the work of the Bureau of Entomology and of the Federal Horticultural Board. The chairman of the committee appeared before the Committee on Agriculture of the United States Senate, which had before it the agricultural appropriation bill. The measure as passed by the House provided inadequate appropriations for important investigations and control measures and no appropriation at all for the European Corn Borer. The senate committee later increased these items and provided the sum of $500,000 for the European Corn Borer.

The bill then went to Conference Committee. The chairman of the Committee on Policy, on invitation from certain members of Congress, again went to Washington the first week in April and discussed appropriation matters with members of the Conference Committee.

The appropriations for these several activities as finally passed provided larger sums than originally allowed by the House, but smaller sums than inserted by the Senate.

COOPERATION WITH THE NATIONAL RESEARCH COUNCIL

By vote of the Association at the St. Louis meeting, the proposal of the National Research Council, urging our Association to cooperate with the Council, was referred to the Committee on Policy, with power to act.

The Committee on Policy met at Albany, N. Y., April 19, with the following members present: Messrs. Parrott, Felt, Sanders, Burgess and O'Kane. At this meeting Mr. Parrott, representing our Association on the National Research Council,

reported that the Council proposed to set up a Committee on Entomology within the Division of Biology and Agriculture. In the case of the American Phytopathological Society, the Council had already designated the Advisory Board of the American Phytopathological Society as a Committee on Plant Pathology of the Council. It was voted to instruct Mr. Parrott to suggest to the Council that the Committee on Policy, with one member added, be designated as the Committee on Entomology of the Council.

It was voted further to instruct Mr. Parrott to recommend to the Council that it suggest to manufacturers of insecticides, fungicides and allied products that an organization be effected whereby, through joint action, funds might be made available for suitable projects in entomology and in plant pathology.

June 23, four members of the Committee on Policy, Messrs. Parrott, Felt, Sanders, and O'Kane took part in a conference in Rochester, N. Y., at which preliminary plans were adopted for an organization of entomologists, plant pathologists and the manufacturers of insecticides, fungicides and allied products, this organization to be brought about under the auspices of the National Research Council, and to be known as the Plant Protection Institute. At this conference a preliminary draft of a constitution and by-laws was drawn up and the general plan of the proposed Institute was adopted, subject to revision and ratification at a later meeting.

A further meeting was called at Washington, Tuesday, Sept. 28. The Committee on Policy met the preceding evening, with the following members present: Messrs. Newell, Ball, Sanders, Parrott and O'Kane. By invitation Dr. Quaintance, also, was present, as the additional member of our Association designated to serve on the Committee on Entomology of the National Research Council. The proposed plan of work of the Plant Protection Institute was studied in detail and certain changes were agreed on to be proposed the following day.

The following day a number of entomologists and plant pathologists met with a group of manufacturers in the offices of the National Research Council and completed organization of the Crop Protection Institute. In the organization as finally adopted control of the Institute is exclusively in a board of trustees of thirteen members, nine of whom are scientists who must be without commercial affiliations. Three of the nine are entomologists, three are plant pathologists, two are agricultural chemists and one is designated by the National Research Council. The industrial members choose four trustees, three of whom represent the manufacturers of insecticides and fungicides, and one represents the manufacturers of allied products. A temporary selection of the entomological members was made by the executive committee of the Association, pending action by the Association at the annual meeting at Chicago.

In assisting thus in the organization of the Crop Protection Institute the members of the Committee on Policy have not sought to bind the Association, as such, to any further measure of cooperation than appeared to be implied in the vote of the Association in the St. Louis meeting, in which the Committee was instructed to proceeed in the cooperative measures proposed by the National Research Council. It has appeared to the Committee clearly desirable to take advantage of the opportunity for helping to organize the proposed Institute along lines giving proper recognition to the profession of entomology and at the same time to help to shape the activities of the Institute in such fashion as to avoid conflict with existing agencies or duplication of existing lines of effort.

At the basis of the plan of organization of the Crop Protection Institute is a clear recognition of the authority, scope and influence of the American Association of Economic Entomologists in all activities of the Institute that relate to entomology.

At a meeting of the trustees of the Institute, held at New York City December 8, a resolution was adopted providing that in any projects relating to entomology the trustees of the Institute will seek the counsel of the Committee on Policy of the American Association of Economic Entomologists.

State Quarantine Regulations

At a meeting of the Committee held April 19 at Albany, N. Y., it was voted to send to all state quarantine officers a recommendation to the effect that they modify existing state quarantines relating to the European Corn Borer in such manner as to make state regulations uniform and bring them into conformity with the action of the Federal Horticultural Board.

Election to the Committee on Policy

The Committee on Policy recommends to the Association that, in general, on the expiration of the term of office of a member of the Committee, the retiring member should not be immediately renominated to the Committee.

Association Branches

In June the Committee received a proposal that it consider a plan for the formation of a northeastern branch of our Association. The proposition was discussed by members of the Committee through correspondence and the general sentiment was at first favorable. Expressions of opinion were sought, also, from various members of the Association.

As the matter was reviewed further it appeared to the Committee that the question involved was one of far-reaching effect, which should have thorough study by the Association to the end that a policy be agreed on that may guide action not only in the present instance but in the case of future similar proposals from other sections of the country. With this in view the Committee adopted the following recommendation to the Association:

The possible establishment of regional branches of the American Association of Economic Entomologists, such as the proposed Eastern Branch, is a matter of utmost importance since it involves fundamental questions of policy.

To safeguard the essential interests of the Association, it is obvious that consideration must be given to two factors. On the one hand, no step should be taken to discourage the initiative of the members. On the other hand, care must be exercised to prevent competition with the Association. Conferences and field meetings are highly desirable, and such should be undertaken more frequently than have been attempted in the past as they stimulate interest in the subject of entomology and focus attention on economic problems of outstanding importance.

As a guiding principle, it has been suggested that instead of creating formal branches for certain geographical sections, efforts be directed to hold conferences and field meetings of members of the association residing in the same general area of the country who are interested or engaged in similar entomological problems. In other words, attendance at the gatherings should be based primarily on interest in definite projects rather than on residence in designated zones. If this policy prevails little administrative machinery will be required, and the principal items of business will be such as are incidental to the conferences.

Through the agency of such regional gatherings, opportunity will be afforded for a desirable molding of public sentiment. Entomologists can do very much more than is now attempted to direct the sources of information available to the public as to the character and the efficiency of entomological efforts in behalf of national welfare. Great good would be accomplished by holding conferences for the express purpose of observing experimental results of special significance. To such conferences there may be invited leading members of local, state and national agricultural organizations, and men of affairs, who can assist in coordinating civilian enterprises with our entomological activities. With the establishment of the Crop Protection

Institute under the direction of the National Research Council it is hoped that funds will be available for the support of important efforts of this character.

It is obvious that local circumstances may vary greatly and that different groups of members may have to consider special conditions, which will largely determine the plan of activities. Complete freedom should therefore be allowed members in calling conferences, whether regional or of special interest. Likewise, it may well be left to their discretion to determine the character of the meetings, whether conferences or gatherings with definite programs.

The Committee on Policy approves all such projects, but recommends that no active efforts be undertaken for the establishment of formal branches of our Association until and unless the members of the Association have had the opportunity to give the matter mature consideration, have determined that the creation of formal branches is desirable and have formulated principles of procedure.

Insect Control

It is well recognized that introduced insects frequently become established in small areas without attracting notice and may give very little indication of future injurious possibilities until the infested area has increased to such an extent as to make extermination or control exceedingly difficult if not impossible.

It is evident that quarantine regulations, although designed to exclude or prevent the establishment of injurious insects in this country, as a matter of fact can be only partially effective even if there be an excellent system and a most rigid enforcement of regulations.

The above considerations, in connection with the history of introduced insects during the last fifty years or thereabouts, have led to the formulation of certain suggestions which, if put into effect, bid fair to afford increased protection to American agriculture in its various ramifications and at the sime time give more adequate recognition to this phase of economic or applied entomology.

The admirable work of the Federal Horticultural Board in administering and enforcing quarantine regulations with the numerous perplexing questions relating thereto is hereby endorsed.

It is recommended that provision be made in the immediate future for the extension of the service to ports now without adequate inspection.

Attention is called to the fact that quarantine regulations may be extremely rigid and designed to actually exclude certain destructive insects and in the judgment of your committee this type of quarantine should be limited to areas where there is at least a fair probability of absolutely preventing spread or even exterminating the pest.

On the other hand, there are conditions where quarantine regulations cannot be expected to accomplish more than to delay the spread or dissemination of an insect and when these conditions prevail, it is believed that there should be a careful balancing of probabilities and the formulation of restrictions which will result in a maximum degree of protection and a minimum interference with legitimate commercial activities.

In other words, your committee favors a distinction between quarantine measures designed for exclusion and those designed for the purpose of retarding spread.

There is great need of a more general recognition of the economy of checking the spread and controlling pests with a limited distribution. It is not economy to reduce appropriations for this type of work and a liberal policy is therefore advocated toward projects of this nature because they promote the general welfare in a most substantial manner.

The eatly detection and speedy control or extermination of destructive insects while they are still limited to comparatively small areas, is a matter of increasing importance.

Owing to the peculiar problems involved and the fact that control or exterminative measures necessitate an organization of specially trained men if the best results are to be secured, it is recommended that a Branch for the Control of Destructive Foreign Insects be established under the general direction of the Chief of the Bureau of Entomology, this Branch to be composed of experts specially qualified for carrying out repressive and exterminative measures.

It is obvious that the early recognition of recent introductions will promote the control of newly established pests. This is an important phase of economic entomology. An insect survey designed to ascertain the distribution and the extent of injury caused by various insects and to keep official entomologists throughout the country apprised of developments during the growing season would prove of great value in forecasting probable injury. It is recommended that an Insect Survey be organized under the direction of the Bureau of Entomology in cooperation with official entomologists of various states or state institutions.

The recent establishment of a Crop Protection Institute affords much needed opportunities for coordinated work on certain general problems relating to the more efficient control of insect pests and plant diseases. It is believed that the greatest opportunity for this organization in the immediate present lies in establishing a substantial unity of interests among its diverse membership and the demonstration of possibilities in the promotion of regional, coordinated studies by specialists along one line and of diverse specialists uniting in the solution of problems requiring special knowledge and training in several related sciences.

It is recommended that the Crop Protection Institute be endorsed and that an expansion of its field be recommended by this Association and that all members of the Association be urged to become members of the Institute.

It is recommended that the Association nominate and elect three members to the Board of Trustees of the Institute as provided in its constitution.

Publications

It is apparent that popular articles concerning insects such as are published in newspapers and other periodicals, should be stated with greater accuracy if the public is to receive correct information. While striking and pithy statements are essential in such publications, they should not be used in place of facts.

There is at present a multiplicity of short, popular bulletins. These doubtless are valuable in so far as they are distributed to the people who are most interested in the subjects treated. A reasonable amount of funds seems to be available for publications of this character by Federal and state institutions.

The publication of original matter, as distinguished from compilations, ought to be confined to such publications as will reach those who are most in need of the information. Under present conditions, economic workers have great difficulty in keeping informed as to the latest discoveries that have been made along the lines in which they are most interested. It is therefore recommended that the reports of experimental work containing original matter should be published in bulletins of institutions or recognized scientific journals, and not in newspapers, magazines, or circulars devoted to activities unrelated to entomology.

Where early publication of important results is demanded by conditions affecting the problem, and all recognized sources of publication are taken for months in advance, it may be necessary to publish in unusual media, but in such case copies should be deposited in the Library of Congress, U. S. Bureau of Entomology and as many entomological centers as possible and information should be brought to the attention of the profession in general.

The opportunity for publication of extensive works on entomology which are invaluable to the profession, are extremely limited, but until extensive bibliographies, synoptic tables covering many of the important insects and their larvae, and handbooks such as every professional entomologist needs for reference, can be issued, the effectiveness of every worker is bound to suffer. Such publications, under present conditions, are extremely expensive, and there are not sufficient professional entomologists to make these publications financially profitable. An endowment fund to cover such publications has been suggested, but sources from which it can be raised, have not been indicated. It is hoped that within the next few years, prices of printing may reach a more normal level, and if the profession continues to grow as we have good reason to expect, it should be possible to finance and publish some of the more worthy manuscripts that are now available.

W. C. O'KANE
WILMON NEWELL
A. F. BURGESS
E. P. FELT
P J PARROTT
E. D. BALL
HERBERT OSBORN
W. D. PIERCE
J. G. SANDERS
Committee

In connection with the recommendation concerning the formation of regional branches, Mr. W. E. Hinds asked if it would interfere with the informal organization known as the "Association of Cotton States Entomologists".

He was advised by the President that it would not.

SECRETARY BURGESS traced the movement that was started in March 1920, relative to forming a Northeastern branch of the association.

A committee consisting of Mr. W. E. Britton, Mr. D. J. Caffrey, and himself, had this matter under consideration, canvassed the membership in the northeastern territory which responded very favorably to the proposal, and referred the matter to the committee on policy and executive committee of the association for approval. A field meeting was held at Philadelphia and Riverton, N. J., in July, in connection with the Japanese Beetle project, and no opposition to the plan developed. At this time the sentiment of the committee on policy was favorable, but later the committee took the view indicated in the resolution.

He stated that he was very much in favor of the formation of regional branches, believing that they would stimulate local interest and enable many of the younger members to attend meetings which under persent conditions is impossible.

PRESIDENT NEWELL stated that both the executive committee and the committee on policy had given the question a great deal of careful consideration, but as this is a rather new proposal, it is believed that

there should be further consideration by the members of the association before definite action was taken.

MR. W. C. O'KANE stated that he was at first favorable to the proposal, but was now not quite sure as to whether it was a good idea or not. He desired to have more information as to how such a plan worked out in other associations, and believed that a study of the matter should be made.

MR. E. P. FELT remarked that he was in favor of regional branches; but that if the idea was a good one, it would not suffer by action being delayed for a year or two until the matter could be given careful consideration.

MR. H. A. GOSSARD questioned the effect that regional branches would have on the interest of the members in the general association and the possibility that their establishment might prevent some members from attending the annual meetings of the association on account of smaller branch meetings being held at points where less travel would be necessary for some members to attend. He also raised the point as to whether vigorous and influential branches might not operate to the disadvantage of the general association, and stated that he believed that the matter should be considered for another year before a decision was reached.

MR. C. T. BRUES pointed out the value of branch meetings to young men who were being trained and were becoming interested in entomology and who seldom have opportunity to attend any regular meeting of the association, and suggested that the plan might be tried experimentally before it was put on a permament basis.

SECRETARY BURGESS closed the remarks on this resolution by stating that the experience of the association with its present sections and one branch indicated that they had been a means of strengthening the association.

MR. C. L. MARLATT suggested a revision of the resolution concerning the activities of the Federal Horticultural Board with particular reference to the work of the board being confined to quarantines, and after general discussion, it was voted to make the revision suggested by him.

There was a general discussion of the resolution relative to the establishment of the Crop Protection Institute, the particular point being made that members of this association elected to the board of trustees should not be immediately re-elected after their terms expired, but no change was made in this particular recommendation.

MR. R. N. CHAPMAN called attention to the interest of manufacturers of cereal products in controlling insects affecting stored foods and sug-

gested that the Crop Protection Institute ought to be broadened so that manufacturers interested in this line could participate.

On motion of Mr. E. D. Ball it was voted to amend the recommendation endorsing the Crop Protection Institute by placing the association on record as in favor of an expansion of its field.

By vote of the association, the report was adopted.

SECRETARY BURGESS stated that he had been authorized to borrow $1500 to complete the financing of Index No. II. Seven hundred and fifty dollars of this amount had been secured by $25 loans from members of the association and $300 should be raised by such loans at the meeting in order to take care of the printing bill when it came due. He requested members who were willing to make such loans to do so during the meeting.

(One hundred dollars in loans was secured before the meeting adjourned.)

He also stated that he had received a number of suggestions in regard to eliminating the discussions published in the annual report of the meeting and a proposal to discontinue the practise of having a stenographer's report, in order to save expenses. A further saving might result from discontinuing the publication of the list of officers, meetings, and members in the February number of the JOURNAL.

MR. E. P. FELT called attention to an editorial in the December number of the JOURNAL which probably had not been read by most of the members, relative to the difficulty in publishing short papers and articles that might be submitted by members during the year. Owing to the large number of papers, some of which are rather long, that are submitted at the annual meeting, it was impossible during the past year to publish short papers.

A study of the average length of papers published in the JOURNAL shows that they approximate six pages. If short articles are to be published by members who cannot attend the meeting, some regulation in regard to the length of papers is necessary.

A general discussion followed and it was voted that the maximum length of contributions in the JOURNAL this year shall not exceed six pages of printed matter; that no papers be published in the JOURNAL while other avenues of publication are available, and that papers which are likely to be published in a year, be submitted only in abstract form.

It was also suggested that a great deal of discussion at the business sessions be eliminated from the JOURNAL.

The final business was transacted Friday afternoon, December 31st.

PRESIDENT WILMON NEWELL: The first report is that of the auditing committee:

REPORT OF THE AUDITING COMMITTEE

CHICAGO, Ill., Dec. 29th, 1920.

The Auditing Committee desires to report that it has examined the accounts of the Secretary including those relating to the first and second Indices of Economic Entomology, the JOURNAL OF ECONOMIC ENTOMOLOGY and the Association and has found them to be correct and admirably kept.

The disbursements in all cases are supported by cancelled checks or other vouchers with the exception of minor amounts involving the shrinkage due to the varying rates of foreign exchange which have caused the banks to deduct from the face value of foreign checks the discount due to this cause and which loss, in the opinion of your committee, could not in any way have been obviated by your diligent and scrupulous secretary.

The committee also has examined the account submitted by Dr. W. E. Hinds relating to the Entomological Employment Bureau and finds this to be correct and accompanied by Dr. Hind's personal check covering the amount of the balance as shown in this account and which has been turned over to your secretary.

Respectfully submitted,

W. R. WALTON
J. W. MCCOLLOCH
Auditing Committee

It was voted to adopt the report.

PRESIDENT WILMON NEWELL: We will now hear the report of the committee on resolutions.

REPORT OF THE COMMITTEE ON RESOLUTIONS

1. RESOLVED, That the announcement to members calling for titles to be read at future annual meetings contain the following notice:

"Members are urged to propose one title only unless the additional subject is one of unusual and general interest. The time asked for presenting a subject of general interest must in no case exceed fifteen minutes. Subjects should be presented from written copy and not presented extemporaneously unless time can be saved by so doing. Members are urged to prepare summaries which will set forth results rather than enumerated details."

2. RESOLVED, That this Association desires to record its sympathy with the work of the Committee on Cooperation and Coordination of the National Research Council in its efforts to preserve species of birds or other animals liable to extinction, provided that such efforts do not conflict with necessary measures for insect control.

3. RESOLVED, That the American Association of Economic Entomologists express its thanks to the authorities of the University of Chicago for the opportunity of holding its meetings in the University, and also for other privileges enjoyed through their courtesy.

Respectfully submitted,

A. G. RUGGLES
ARTHUR GIBSON
M. C. TANQUARY
Committee

By vote of the association, the resolution was adopted.

MR. G. M. BENTLEY: I would like to present to the association a resolution that was adopted by the Section on Apiculture.

RESOLUTION ON BEE DISEASE CONTROL

Adopted by the Section on Apiculture, December 29, for action by the Association.

"The Section on Apiculture of the American Association of Economic Entomologists hereby expresses its approval of the informal agreement made by the apiary inspectors of the North Central States and Canada at a recent meeting, as follows:

Section 1. Resolved that the undersigned apiary inspectors of the North Central States and Canada believe and agree that inspection certificates for the interstate transportation of bees and used apiary supplies should be given only to apiaries which have never been infected or which have been free from American Foul Brood for at least one year.

Provided, however, that bees in combless packages supplied with food made from pure sugar only are exempted from the provisions of this Section.

Section 2. It is further agreed that whenever a case of the interstate transportation of bees or used bee supplies, with or without an inspection certificate, comes to the attention of the apiary inspector of any state, full information will be sent to the state inspector of the state of destination.

It is the further belief and recommendation of the Section on Apiculture that Federal Legislation providing for the regulation of the interstate transportation of bees and used apiary supplies should be enacted."

It was voted that the association endorse this resolution.

PRESIDENT WILMON NEWELL: The report of the committee on membership is now in order.

REPORT OF THE COMMITTEE ON MEMBERSHIP

The committee on membership submits the following report, and recommends for election to associate membership:

Albert, Theo., Chehalis, Wash.
Alden, Charles H., Bureau of Entomology, Washington, D. C.
Balduf, Walter V., Ohio State University, Columbus, Ohio.
Bartley, Hastings N., 43 Tremont St., Boston, Mass.
Bazeley, William A. L., 519 State House, Boston, Mass.
Blanchard, Everard E., San Isidro, Argentina, So. America.
Boyden, B. L., Daytona, Florida.
Bradley, William G., Agricultural Experiment Station, Louisiana State University, Baton Rouge, La.
Brimley, Clement S., North Carolina Department of Agriculture, Raleigh, N. C.
Brinley, Floyd J., Riverton, N. J.
Brown, Luther, Agricultural College, Miss
Bynum, E. K., Ocean Springs, Miss.
Carpenter, Hall B., 58 Central St., Somerville, Mass.
Chafin, Jeff, Gainesville, Fla.
Chamberlin, Frank S., Quincy, Fla.
Craighead, Eugene M., Bureau of Plant Industry, Harrisburg, Pa.
Currier, Donald Locke, Hall of Justice, San Jose, Calif.
Darlington, P. S., Wenatchio, Wash.
DelCurto, J. M., State Department of Agriculture, Austin, Tex.
Detwiler, John D., 117 Eddy St., Ithaca, N. Y.
Dozier, Herbert L., Agricultural College, Miss.
Drake, Carl J., N. Y. State College of Forestry, Syracuse, N. Y.

Fisher, Charles K., 126 S. Minneapolis Ave., Wichita, Kansas.
Frank, Arthur, Western Washington Experiment Station, Puyallup, Wash.
Gilbertson, G. J., Brookings, S. D.
Graham, Frank W., 167 Waverly Ave., Melrose, Mass.
Haber, Vernon Raymond, 225 Linden Ave., Raleigh, N. C.
Hain, Russel M., East Lansing, Mich.
Hawkins, Kenneth, Watertown, Wis.
Hester, J. G., Box 1, Agricultural College, Miss.
Holbrook, John E. R., 17 E. Highland Ave., Melrose Highlands, Mass.
Huber, L. L., Ohio State University, Columbus, Ohio.
Huckett, Hugh C., 804 East Seneca St., Ithaca, N. Y.
Jaenicke, Alex. J., Care of U. S. Forest Service, Portland, Ore.
Jaques, Harry E., Mt. Pleasant, Iowa.
Jones, Wyatt W., 700 McCormick Bldg., Salt Lake City, Utah.
Kannan, K. K., Stanford University, Calif.
Kelley, E. B., 214 Columbia Bldg., Spokane, Wash.
Kelty, R. H., East Lansing, Mich.
King, Kenneth M., U. S. Entomological Lab., Charlottesville, Va.
Kinsey, Alfred C., Indiana University, Bloomington, Ind.
Landers, Daniel D., Cor. Nahant & Farm Streets, Wakefield, Mass.
Leach, B. R., U. S. Bureau of Entomology, Washington, D. C.
Lewis, Clarence W., 28 Albion St., Melrose Highlands, Mass.
Mabee, W. Bruce, Raleigh, N. C.
Maloney, James O., Agricultural College, Miss.
McIntosh, Allen, Agricultural College, Miss.
McDonald, R. E., State Department of Agriculture, Austin, Tex.
Miller, A. E., 67 W. 10th Ave., Columbus Ohio.
Mitchell, Theodore B., Department of Agriculture, Raleigh, N. C.
Newbegin, Irving B., Wakefield, Mass.
Paarmann, J. H., 1532 Clay St., Davenport, Iowa.
Pearson, George B., Box 95, West Lafayette, Ind.
Peirson, Henry B., Harvard Forest, Petersham, Mass.
Pollock, John H., Box 423, Colorado Springs, Colo.
Reeher, Max M., Forest Grove, Oregon.
Richardson, Theodore R., 43 Tremont St., Boston, Mass.
Robinson, Charles L., Court House, Yakima, Wash.
Root, E. R., Medina, Ohio.
Rounds, M. B., 824 N. Curtis Ave., Alhambra, Calif.
Scullen, H. A., Corvallis, Oregon.
Stage, Harry H., 1608 Oak St., Pine Bluff, Arkansas.
Tillery, J. L., Concord, Tenn.
Uichanco, Leopoldo B., Bussey Institution, Boston 30, Mass.
VanDuzee, E. P., California Academy of Science, G. G. Park, San Francisco, Cal.
Wakeland, Claude C., Paonia, Colo.
Walkden, Herbert H., 126 S. Minneapolis Ave., Wichita, Kansas.
Willson, Robert B., Agricultural College, Miss.
Wood, Elwin G., State College of Washington, Pullman, Wash.
Yuasa, Hachiro, University of Chicago Chicago, Ill.

For foreign membership:

Dr. R. J. Tillyard, Cawthron Institute of Scientific Research, Nelson, New Zealand.

Thomas Harvey Johnson, M.A., D.Sc., Professor of Biology, University of Brisbane, Queensland, Australia.

For transfer from associate to active membership:

Armitage, H. M.
Atwood, George G.
Barber, T. C.
Burrill, A. C.
Chandler, W. L.
Chase, W. W.
Cleveland, C. R.
Cole, Frank R.
Clausen, C. P.
Cotton, R. T.
Crawford, D. L.
Fenton, F. A.
Ford, A. L.
Frost, S. W.
Hagan, H. R.
Hall, M. C.
Hawley, I. M.
Herbert, F. B.
Howard, Neale F.
Jones, C. R.
Kennedy, C. H.
Larrimer, W. H.
Larson, A. O.
Lathrop, F. H.
List, G. M.
Loftin, U. C.
Mackie, D. B.
McDaniel, Eugenia
Merrill, G. B.
Mosher, Edna
Moznette, G. F.
Neuls, J. D.
Nougaret, R. L.
Oestlund, O. W.
Packard, C. M.
Sanford, H. L.
Seamans, H. L.
Smulyan, M. T.
Stearns, L. A.,
Van Dyke, E. C.
Van Zwaluwenberg, R. H.
Vickery, R. A.
Weigel, C. A.
Wolcott, G. N.
Wood, H. P.

To be reinstated to associate membership:

Champlain, Alfred B., Harrisburg, Pa.

The committee recommends that the dues of Albert Koebele and John H. Comstock be remitted and their names be retained on the roll; that the resignations of the following members be accepted:

Gates, Burton N.
Hart, Herman J.
Mason, S. L.
McGehee, T. F.
Smith, H. P.
Vansell, G. H.

That five active and seventeen associate members who are in arrears for dues for two years be notified by the Secretary that if the amount due the association is not paid promptly, their names will be dropped from the roll.

Respectfully submitted,

T. J. HEADLEE
E. R. SASSCER
A. G. RUGGLES
Committee

By vote of the association, the report was accepted and the recommendations adopted.

PRESIDENT WILMON NEWELL: The report will now be presented by the committee on the U. S. National Museum.

REPORT OF COMMITTEE ON U. S. NATIONAL MUSEUM

Your committee begs leave to report, as follows:

First: Activities during the year 1920.

In order that all might understand the importance of the Division of Insects of the U. S. National Museum and realize its needs to handle the vast volume of material submitted to it by entomologists for study and information, our report, submitted at the last annual meeting at St. Louis was printed in *Science* as well as in the entomological journals, and reprints furnished to entomologists throughout the country for their use in advising on the subject. As a result the report was approved and assistance extended by the National Research Council, the Florida Entomological Society and the Indiana Academy of Science.

An itemized budget was not included in our report a year ago but the past year this matter has been carefully studied and a budget totaling $83,660 was decided upon as the amount needed at once. This amount is considered adequate to provide the needed curators, assistants and preparators, and will also furnish a suitable allowance for the purchase of needed supplies and equipment and permit a small amount for travel and exploration and in addition make it possible to inaugurate proper facilities for publication. This budget was presented to Dr. C. D. Walcott, Secretary of the Smithsonian Institution, October 1 with the urgent request that he include the item in his budget for the National Museum. This could not be done as the budget had been sent to Congress previous to June but Doctor Walcott generously agreed to approve the item provided its inclusion by the house committee could be secured. Consequently the matter was taken up with Congressman Good, Chairman of the House Appropriations Committee, Doctor Walcott at the same time approving the item in a letter to Chairman Good. To this request we were advised that owing to the deficiency in the Treasury and the many needs confronting Congress that additional appropriations could not be considered at this time. After careful consideration your committee believes it advisable to refrain from pushing the matter at the present session of Congress but to request insertion of the item in the Museum budget at the next session of Congress.

Second: Support needed. Your committee urges every member to be in readiness to secure the indorsement for National Museum support if needed. This refers to personal contact with your representatives in Congress or otherwise securing their support. We would urge especially that the scientific societies of the different states be advised of the needs and that their indorsement be secured and likewise that the approval and support be secured from such agricultural bodies as the state horticultural societies, agricultural societies, etc.

We would urge that each one of you take every opportunity to educate the people relative to the importance and needs of the National Museum as a whole for we must build up every branch of the Museum if in future years we are to maintain a normal growth and expansion of the Division of Insects.

Third: Deposition of Types in the U. S. National Museum. Your committee feels that the National Museum should be the mecca for taxonomic entomological activity in the United States and would urge that entomologists make it a point to deposit types in the Museum. We would urge state institutions to likewise place the types, now in their collections, in the custody of the National Museum. This is already being done by certain institutions. Thus the type collections of the Connecticut Agricultural College, Colorado Agricultural College, Kansas Agricultural College, The Norton Collection at Yale, and others, will all probably soon be in the National Museum. We cannot urge too strongly that other institutions and individuals

follow suit. In return the Division of Insects of the Museum promises to give the donors species new to their collections and help to build up their collection along the lines which will be most valuable to them. They further agree that any of the types thus deposited are accepted on the condition that they can be borrowed by the institution at any time and for any reason, but they are not to go to any institution or individual, not connected with the institution presenting the material.

Respectfully submitted,

JOHN J. DAVIS
W. J. HOLLAND
V. L. KELLOGG
E. P. FELT
HERBERT OSBORN
Committee

By vote of the association, the report was adopted.

PRESIDENT WILMON NEWELL: Nominations by the advisory committee for the officers of the JOURNAL OF ECONOMIC ENTOMOLOGY are now in order.

DR. L. O. HOWARD: On behalf of the advisory committee, I will renominate the officers that served during the past years.

By vote of the association, these officers were re-elected.

PRESIDENT WILMON NEWELL: The next in order is the report of the committee on nominations.

REPORT OF THE NOMINATING COMMITTEE

For President, George A. Dean.
First Vice-President, Arthur Gibson.
Second Vice-President, E. O. Essig.
Third Vice-President, A. G. Ruggles.
Fourth Vice-President, H. F. Wilson.
Secretary, A. F. Burgess.
Committee on Policy, Wilmon Newell.
Committee on Nomenclature, Edith M. Patch.
Committee on Membership, J. S. Houser.
Committee on U. S. National Museum, Herbert Osborn.
Representative National Research Council, P. J. Parrott.
Councillors for American Association for the Advancement of Science, A. L. Quaintance, T. J. Headlee.
Trustees Crop Protection Institute, W. C. O'Kane, 3 years; P. J. Parrott, 2 years; J. G. Sanders, 1 year.
Advisory Committee, C. H. Popenoe, H. A. Gossard.

Respectfully submitted,

JOHN J. DAVIS
C. L. METCALF
J. E. GRAF
Committee

By vote of the association, the committee was instructed to cast the ballot of the association for the nominees mentioned in the report, and they were declared elected.

PRESIDENT WILMON NEWELL: Will Past Presidents Howard and Felt conduct Mr. Dean to the Chair?

MR. GEORGE A. DEAN: Mr. Chairman and Gentlemen: If my heart, which is trying to function in my throat, would just drop down to the location that it should occupy normally, I will try to express in my weak way my appreciation of this great honor that you have bestowed upon me. I have never had such a feeling come over me as I have right now. It is not one of joy; nor is it one of sorrow or regret; perhaps it is a feeling that comes over one when he suddenly realizes how unworthy he is of the great confidence and faith that his friends have placed in him. I trust I will realize to no small degree the responsibility of this position. I hope that I may have the support and the help of all of you, and that I may be able to grasp some of the essential problems of our great Association. If it were not for the splendid men that are on the Executive Committee and the Committee on Policy, and all these other important Committees, and the splendid men that are in the Association, I never would think for one moment of assuming this responsibility. I trust I am in position and I believe I am,—to give considerable of my time to the Association. This I do know: the interest of this Association will be paramount in my mind, and I promise you, without any reservations, that I will give you the best there is in me. (Applause)

PRESIDENT WILMON NEWELL: Is there any miscellaneous business?

MR. ARTHUR GIBSON extended an invitation to the association to meet in joint session with the Entomological Society of Ontario at the annual meeting next year at Toronto.

The President expressed appreciation for the invitation and on motion the matter was referred to the executive committee with power to arrange the details.

The Secretary called attention to the members of the success of the joint session with the Phytopathologists and asked whether arrangements were desired for a joint meeting next year.

It was voted that this matter be left to the executive committee with power to act.

It was voted that the time and place of the next meeting be left to the executive committee.

On motion of Dr. L. O. Howard, a resolution of thanks was extended to President Newell for his successful handling of the meeting.

PART II. ADDRESSES, PAPERS, AND DISCUSSIONS

Morning Session, Wednesday, December 29, 1920

After the routine business of the opening session had been transacted, President Newell introduced Dr. C. E. McClung, chairman of the Division of Biology and Agriculture of the National Research Council, who spoke as follows:

It is a great pleasure to meet with you and to discuss briefly some of the problems which confront the Council. I should like, in the first place, to acknowledge the indebtedness of our Division and of our Executive Committee to the efficient services of your respresentative, my old friend, Dr. Parrott. As he has told you in his report, he has attended all of our meetings and has contributed very largely to the discussions that have been held.

This morning I should like very briefly to indicate to you the nature of the Council and some of its problems. It is especially important that you understand what this organization is. There is much misapprehension, some of it natural, some of it, I am sorry to say, cultivated. It is particularly important that you know that this organization is your own. It is not something which exists outside of the national scientific societies; it is a creature of those societies, and it represents you as an organization. The unit on which the Council is established is a national scientific society. It is not an organization to impose upon any individual or group of individuals any policy or method or point of view. It is in effect, as Dr. Parrott has told you, a congress of the scientists of the country, an organization through which they may express their views, through which they may operate in the execution of their projects, and in no sense is it designed to impose any plan or any point of view upon the scientists of the country.

I want to be especially emphatic about that because you will be told by those who have not looked into the matter that there is some effort on the part of certain persons, undesignated, to attempt the control of the scientific life of the country. In the nature of the organization that is quite impossible. It was designed especially to prevent any such thing as the development of a group that might wish to do such a thing as that, because the members are elected for short periods of time and the officers for a year.

I happen to be in Washington this year, and Dr. Jones of Wisconsin will be there next year, and somebody else will follow him as Chairman of our Division. The organization is plastic and moves rapidly, and there is nothing in the nature of it which would make possible a coercive body. On the other hand, it does offer the scientists of the country a

form of organization which can be made effective in a great many ways, and that is to be determined by those who wish to be served and not by any one else.

You can readily see that with a group of men in Washington representing the different sciences—men permanently on the job—you may hope more effectively and readily to accomplish your purposes than if you have to work through the looser organizations which have heretofore existed. You have in effect, in appointing your committee on cooperation in the Council, a permanent court representing you to which we can appeal for advice on the subject of entomology. The Division of Biology and Agriculture is unique in this respect: that we have asked all of the societies represented in this Division to name these Committees.

Dr. Parrott has told you that the Council is in a state of development and its entire organization is such that it may be changed at any time to meet the needs of the scientists of the country. Its subsidiary organizations are of the same nature, and the Crop Protection Institute is of like character. The Council has no other interest in this particular Institute than to serve as a means of bringing together groups which we are told had heretofore not been able to get together. That represents in general one of the large functions of the Council.

When the matter of bringing this proposed Institute to the attention of various scientific societies was discussed, I suggested that the Phytopathologists be considered, and it was found that it would be desirable for them to work in cooperation with the entomologists. I have been told that the phytopathologists have already, as a society, endorsed this project, so that if your Association decides to do so the matter will be well started.

Already we have had statements from the Forestry Committee that they are interested in this matter, and it may be that it would be desirable to include representation from the foresters, and to extend it possibly to others.

This represents perhaps, the only immediate way in which the Council has been of service to the entomologists so far, but I should like very briefly to point out to you that there are other connections which you may set up. One of those has already been referred to by one of your speakers in reference to the protection of natural areas. The Ecological Society has a Committee which has done a large amount of work in the effort to preserve for scientific study areas which are in a natural condition now but which are very soon to disappear entirely.

You will at once realize that conflict of interest may be set up in anything of this sort. Some of those were briefly referred to. Some organizations might want to preserve areas that harbored very destruc-

tive parasites, insects, fungi or other things. It would be a question to decide whether it is more desirable to keep that area or to get rid of that particular group of destructive organisms. That would be difficult unless you had, as you have in the Council, a congress of scientists already established to consider these matters for you. Always it should be the case that if these are of great importance they come back to the different societies for final action as they have in the case of this Crop Protection Institute. That should be an invariable practise of the Council, because as it represents the societies it ought to take every precaution to see that that representation of sentiment is as full and as exact as can be obtained.

I should like very briefly to speak of several connections which you might as entomologist set up with projects in process of organization and which would be of much possible interest to you. One has also been briefly referred to here—that of the relation between entomology and forestry. We have a very active and energetic forestry committee which has now in progress an extensive investigation in the Southern States upon the reforestation of that region and upon methods of sylviculture. I should just like to speak of this for a moment to indicate to you how connections are established and projects put under way. This committee represents the American Forestry Association, and presented to that Society certain projects which it thought of greatest significance. Two of them were the ones which I have mentioned. In order to be certain that the Council should not undertake something for which provision was already made, after these projects had been properly approved, I went to the Chief Forester and explained the situation to him, asked him if this work duplicated the work of the Forest Service and if not did he consider it a desirable thing to undertake. It was at once approved by the Chief Forester, and then Dr. Howe, Chairman of the Research Extension Division of the Council, who assisted you in the organization of this Crop Protection Institute, addressed the Southern Pine Growers' Association and received from them a grant of $10,000 for the prosecution of this project.

The Chairman of the Committee told me the other day that already from the Forest Service and from the state services contributions equivalent in amount to what the Southern Pine Growers had contributed had been received.

This Committee on Forestry, it seems to me, could very properly be put in relation to your Committee of Entomology to determine what best could be done in the matter of forest entomology, if there should be things for which you do not already have provision, as I judge to be the case from what has already been suggested.

We have a Committee representing the Horticultural Society, which I should think could in many cases be put directly into relation with the work of the entomologists. This Committee recently had a meeting in Washington and has undertaken to determine the presence and extent of various kinds of fruit plants in the country in order that they may be preserved and brought together for better service.

The Committee on Phytopathology has already been brought into relation with the work of this association and the Crop Protection Institute. There may be other connections which you could set up. If, so, the agencies are already provided.

We have under way the organization of an institute for tropical American research, and recently in Washington we had reports from the men in the Philippines who have been responsible for the excellent development of scientific work there. Some of our own fellow-scientists have spent as many as eighteen years in the Philippines developing a group of institutions which stand out most prominently as an achievement of American science.

It is pointed out to us that this country of all large countries has the least knowledge and least connection with the tropics and that in the future the food supplies and the raw products in particular must in a largely increasing degree come from the tropics.

It was mentioned, for instance, that in this country we use, as I recall it, over eighty per cent. of the rubber of the world, whereas Great Britain controls ninety per cent. of the source. As you have read in the newspapers, we cannot lay cables because Great Britain has control—entire control—of gutta-percha, and it leads to an international complication simply because this raw product is unavailable to us. Many such instances were pointed out.

We called a meeting of representatives of the large universities, museums, and societies in Washington, to consider the organization of an institute for tropical American research. This is being put actively under way. There is a Committee at work on the organization of this institute, and we have assurance from the Pan-American Union and the State Department that the efforts will be encouraged in every way. It is certainly true, I should think, that the entomologists would be greatly interested in the organization of such an institute as the tropical American research institute.

We have a Committee on Food and Nutrition, whose work in the preservation of foods particularly comes into close connection with the entomologists.

There are many of these things; I have spoken merely of a few in the Division of Biology and Agriculture. I have done this merely to direct

your attention to the situation and to ask your earnest support of the work of your representatives in the Council, which I can assure has been of the highest order.

I thank you very much for the opportunity to present the work of the Division. (Applause)

PRESIDENT WILMON NEWELL: Our thanks are due Dr. McClung for this very clear explanation of the work of the National Research Council and our relationship to it.

Another paper along similar lines is that by Mr. W. C. O'Kane, on "Industrial Support for Scientific Work."

INDUSTRIAL SUPPORT FOR SCIENTIFIC WORK

By W. C. O'KANE, *Durham, N. H.*

(Withdrawn for publication elsewhere)

Adjournment.

Afternoon session, Wednesday, December 29, 1920, 2.15 p. m.

Vice-President Gossard in the Chair.

VICE-PRESIDENT GOSSARD: We will now listen to the Presidential Address, "On the Organization of Work in Economic Entomology," by President Newell.

ON THE ORGANIZATION OF WORK IN ECONOMIC ENTOMOLOGY

By WILMON NEWELL, *Gainesville, Florida*

Considering the relatively short period during which our profession has been adapted to important practical and economic ends its development has been marvelous. It may be that because of this growth work in economic entomology is not as thoroughly organized as in some of the older professions or vocations. The time has undoubtedly arrived when we must give thoughtful attention to so coordinating and organizing our activities, both as individuals and as groups of individuals, as to place our profession on that high plane which its usefulness to society justifies.

Much is implied in the term "organization". In reality it covers everything in the entomological field from teaching a student the principal parts of the grasshopper's anatomy to the management of relatively large and momentous undertakings, such as eradicating an injurious insect or excluding foreign pests from our country.

The present status of work in economic entomology, taking the United States as a whole, must appeal to the student of organization as being somewhat chaotic. Various state agencies, such as experiment stations, boards of entomology and horticulture, state departments of agriculture and plant boards are working on entomological problems; in many instances without adequate funds and in most instances in ignorance as to whether the same problem is being investigated by other state workers, by the Bureau of Entomology or by both. At the same time we find the Bureau of Entomology establishing field laboratories throughout the country for the study of various insect problems, some of the latter almost national in scope but many of them also local in character. The state entomological workers in the states where these laboratories are located are not infrequently in ignorance of the particular objects sought by the federal investigators and may even be ignorant of the major lines of effort or the problems being pursued. It may easily happen that both state and federal entomologists may work upon the same problem, entirely without co-operation. Is this condition conducive to securing the maximum of efficiency and useful results with a minimum expenditure of time and resources?

The speaker is convinced that there is room for vast improvement along these lines and, what is more important, improvement must be made in this direction if the entomologists are to maintain a prestige which will compare favorably with that earned by workers in other lines of agriculture.

The entire question of organization and all that it implies is a very broad one and we cannot hope to do more, in this brief essay, than to direct your attention to some aspects of organization in the entomological field. This we propose to do with reference to (1) the individual worker, (2) workers in other lines of agriculture, (3) major projects and (4) the relationship between federal and state workers.

1. The Individual

It is not our purpose to discuss the work of the teacher of entomology for the same pedagogical principles apply here as in the teaching of other biological subjects. Neither do we include in our field of discussion the entomologist *per se*, meaning by this the person who pursues the study for the primary purpose of securing entomological information without particular regard to its economic application. The primary requisite for such an entomologist is time in which to pursue his labors.

It is with the organization of entomological work of an economic nature that we are now concerned, for our profession takes on certain aspects of business in that the information we seek or impart is to be

applied to practical ends; if not in the immediate future, then ultimately. Knowledge such as we use may be compared to the stock in trade of a commercial house in that it should be readily available when needed or called for. If we find there is a coming or growing demand for certain information which we do not have in stock good business practice demands that we proceed to "stock up": in other words, acquire the needed information, usually by research methods. Our research projects, unlike those of the entomologist *per se*, must in most cases be completed within a specified time and the "goods delivered" when they are needed. Research along the lines of economic entomology must therefore recognize the time factor and he who pursues such investigations leisurely and without having in view definite accomplishments within a specified time is neglecting one of the cardinal principles of success.

The organization of the individual entomologist's work is mainly a question of personal efficiency and many factors play a part in it. The proper selection of problems upon which to work often determines whether a year or more of time is advantageously used. The need of the day is clearly for entomological results that admit of practical application. This is the object of economic entomology and the worker must needs guard against devoting his time and efforts to problems which are not of prime economic importance.

No economic entomologist can ever say that his day's work is "done" for if he considers it as finished it is but proof that he has failed to see the opportunities all around him—for experimentation, for service to the public and for extension of entomological knowledge. The amount of work confronting every entomologist is, for all practical purposes, infinite and a fine distinction is therefore necessary between those tasks which are most fruitful or important from the standpoint of practical results and those which can be deferred, or even eliminated, without regrettable consequences. "Do not put off until tomorrow what can be done today" is a rule which can rarely be applied by the economic entomologist. Instead, his rule must be: "Do those things today which are most important today." No efficient entomologist commences his day's work without having in mind a definite plan: a conception of what is to be accomplished. True, many unexpected things may develop to prevent the execution of that plan and the latter must be constantly rearranged and readjusted as the day passes, but a definite aim is the first requisite for definite accomplishments.

Freedom from worry over personal financial affairs is one of the most important essentials for good results from the individual worker. Such a condition presumes adequate salaries. Salaries of entomologists are, at the present time, inadequate. It may be argued that they are as good

on the average, as those enjoyed by university professors and others whose duties require similar training and experience. It must be remembered, however, that the services of the economic entomologist possess a definite commercial value, a value in most instances many hundredfold in excess of his compensation. The salaries of our best entomologists should compare favorably with the incomes of our best physicians and lawyers and the salaries of younger entomologists or those in subordinate capacities should be graduated accordingly. The action of this association, at its last meeting, in establishing a standard of values for entomological services was a step in the right direction. It must be remembered, however, that there are many entomologists who are still "pegging away" at unimportant tasks and others who are "marking time" on important projects. Naturally the public does not appreciate their efforts and lack of definite accomplishments by them only tends to minimize the value of services rendered by the profession as a whole. It is also true that as economic entomologists we have not yet accomplished any really stupendous tasks: tasks of such economic importance as to be the subject of comment and commendation by the public generally. When we do, we can talk with better grace about higher salaries.

While on this phase of our subject we wish to remind the student of personal efficiency that he will find a wealth of wholesome advice and inspiration in that masterful address, "The Day's Work," delivered by President O'Kane before this Association one year ago.

2. Workers in Other Lines of Agriculture

In our relationships with other agricultural workers we have vast opportunities for improvement. We have been too prone to regard an insect problem as one for the exclusive attention of the entomologist. Primarily and in so far as the form, habits and biology of the insect is concerned, it is but in the practical application of entomological information much other knowledge, presumably supplied by workers in other lines, is always necessary. The tendency of all scientific workers has undoubtedly been too much in the direction of specialization. What we should do is not to consider a problem as an "entomological" or a "chemical" or a "pathological" one but to consider it collectively, from the standpoint of all the scientific questions involved and bring to bear upon it the combined knowledge and experience of the entomologist and the plant pathologist, agronomist, soil physicist or whatever other specialist is able to furnish information or experience contributing to its solution.

We have also failed, in the writer's opinion, to recognize and apply sufficiently broad principles of insect prevention or "entomological hygiene." In most problems of this character workers in other lines must be called into consultation or even active participation. The prevention of insect outbreaks invariably involves questions of crop rotation in which the agronomist is concerned or practices of pruning or orchard management with which the horticulturist is concerned and not infrequently problems of fertilization, soil management and plant pathology are involved. A broader viewpoint and more liberal practice in these matters are much to be desired.

3. Major Projects

Developments within recent years have made it necessary for entomologists to engage in undertakings involving the services of many individuals. Problems in plant quarantine service, the control of a serious pest over a large area, the eradication of introduced insects, which have become established: all call for organizations of workers far in excess of what was even dreamed of by the entomologists of twenty years ago. These big undertakings have come upon us quickly, in some cases almost overnight, and we have not yet reached a standardized plan or basis of organization for them. The handling of such problems is not unlike that of handling a big factory, with its various departments, or a big commercial enterprise. Organization in entomological work is only in its beginning and it is a subject to which we must give careful thought.

A major project in any branch of applied entomology must have the moral support of the public, or at least that portion of the public directly affected by it. No organization, for example, could hope to eradicate an insect enemy of a staple crop unless the effort were supported by the producers of the crops subject to attack. Public support arises from a knowledge on the part of the public of the merits of the undertaking. Sometimes these are recognized through a threatened calamity, the nature of which is known to all. In other instances this knowledge is the direct result of education but there must always exist a conviction that the undertaking is a necessity.

Ample resources in the way of funds for carrying through the proposed program, together with adequate laws and police regulations are prime necessities.

Public confidence in entomological work has frequently been seriously impaired by failure of the workers themselves to eliminate the possibility and probability of insect pests being disseminated by their own activities. It is always difficult for a property owner to understand why it is unsafe for him to do certain things when it is "all right" for an entomol-

ogist or inspector to do the same things. We regret to say that there have been instances of entomologists transporting living specimens of an injurious form into non-infested territory for the purpose of conducting experiments with them! Failure to exercise every precaution to prevent the spread of injurious insects by the entomological workers themselves, quickly destroys public confidence, the first requisite for public support.

There must be division and subdivision of the working force into groups or departments, each group specializing upon some particular phase of the problem or undertaking; yet the work of all groups must be correlated without perceptibly overlapping.

Conferences between the chief executive and the division or department heads should be held frequently, not only for the purpose of discussing routine matters and thus keeping all familiar with the general work of the organization but also to consider special problems of practice or policy. A wise executive will seek expression of opinion from his department heads and give consideration to their views, even though final decision and the responsibility therefor rests with him. In a sense, the relations of chief and minor executives should be those of general and staff. In like manner conferences should be frequently held between department heads and their subordinates and so on down, until every member of the organization, no matter how humble his position, has been reached.

With all of these conditions fulfilled the success of the organization itself will depend upon many things which, at first thought, may appear to be relatively unimportant. The first of these is morale, something which is hard to define and still harder to create. Morale does not exist unless the workers are men of high moral character, honest, conscientious and good citizens. This requirement is of even more importance than technical training for the particular work in hand. Perhaps one of the greatest factors in morale is leadership and all that the word implies, for the workers must have implicit confidence in their leader, his ability, integrity and sense of justice. He must see to it that there is no partiality as between employees, that promotions are made on merit and ability regardless of the employee's technical training or collegiate degrees. Of equal importance is the prompt elimination from the force of all those who are unfit either through ignorance, laziness or personality. The selection and assignment of executives in minor positions is also of importance as these officials are in closest touch with the actual workers and must reflect in large degree the policies and attitude of those higher in command. Personal contact between field force and headquarters is a vital factor, for leadership is

largely a matter of confidence, based on personal contact and experience. Employees from the lowest to the highest should be given opportunity to offer their suggestions and to confer with fellow workers and leaders. It must be remembered that the humblest workman in a factory may make an important invention or a marked improvement in manufacturing methods: in the same way the humblest field worker may find the solution of difficult problems or a better method which may go far towards insuring the success of the undertaking.

Admitting to the organization persons who receive their appointments for reasons of political expediency, whether such persons be competent or not, will quickly destroy the morale of any force of workers. Justice and a "square deal" are perhaps more instrumental in maintaining morale than any other factors. The employees must have enthusiasm; not the bombastic kind but that kind which manifests itself in duty well performed, in a firm belief in the merits of the project and confidence in its ultimate success. A certain measure of responsibility must also rest upon each individual worker. He must be held responsible for the accomplishment of certain definite things, either great or small, but must, at the same time, feel assured that he will receive credit for what he accomplishes as a factor contributing to his future promotion.

An executive can well afford to be over-liberal with his subordinates in the matter of "credit," for any accomplishment which reflects credit upon a member of his organization reflects credit upon himself as well.

Authority must be centralized. When different agencies, such as the state and federal governments, work in cooperation, the activities of both should be directed by one and the same executive. By this means are duplications of effort, waste of funds and petty jealousies eliminated.

Scientific research must go hand in hand with the actual application of repressive or control measures and should keep pace with the latter. Until recent years entomologists have held quite tenaciously to the contention that thorough life-history studies should precede practically all attempts at control or repressive measures and even today we can see evidence of this belief in the attitude of some entomologists towards the larger entomological problems confronting us. While we do not wish to be understood as discounting in the least the value of such knowledge, nevertheless it does not necessarily follow that a large-scale attempt to control or eradicate an insect pest must wait upon the acquisition of all desired information concerning its biology, parasites, etc. It must be admitted that all possible or available information in regard to a pest is desirable and a certain amount is necessary for intelligently handling an eradication or control project but to hold a project in abey-

ance while scientific investigators are pursuing research work would in some cases mean that the attempt would be foredoomed to failure for if the insect is permitted to have its own way while the investigators pursue their labors, it occupies new territory or increases to such an extent as to make the proposed undertaking impractical of accomplishment because of prohibitive expense. It is much as if an army were to persistently refuse to attack the enemy until all details of the latter's position, strength, weapons, fortifications and reserves are known. Like the army in war, we must rush to the attack without waiting to be sure we will win. To know that we have a "fighting chance" is sufficient warrant for putting forth our strongest efforts and, as in other wars, the advantage is with the side which takes and holds the offensive.

The directors of any project involving the expenditure of relatively large amounts out of the public treasury and affecting in an economic way large numbers of citizens must take the public into their confidence. Judicious but truthful publicity is therefore a necessity. The admission of temporary failures and the acknowledgement of mistakes are as important as supplying to the public information on the encouraging features. This policy of taking the public into our confidence inspires belief in our honesty of purpose and prevents the development of that suspicion with which the layman or the public is so apt to regard work involving scientific men or the expenditure of public funds. Publicity must emanate from headquarters rather than from operatives in the field. The reasons for this are obvious. At the same time, information must be of such a nature as to avoid the appearance of being "propaganda" in the sense that the word is now taken, namely, an attempt to create sentiment for or against an undertaking. It is needless to say that no feature of the work should be so manipulated as to forward personal interests. Even the appearance of such a condition should be carefully avoided. For a nursery inspector, for example, to own stock in a nursery is to at once raise a suspicion in the minds of the public as to his loyalty and to raise in the minds of the nurserymen a question as to the sincerity of purpose behind the entire nursery inspection service.

In an extensive undertaking the executive or directing official occupies the most responsible place. On his character and conduct to a great extent depends the morale of the working force. He must be patient with employees and citizens alike, he must be familiar with all branches of his organization, firm in dismissing those employees who are unfit or who commit any moral error, yet exceedingly charitable in the case of mistakes which are made through ignorance or inability but with the best of motives. In the enforcement of laws and regulations he must

be fearless, yet not foolhardy and must remember that the success of an entire undertaking is sometimes jeopardized by a too zealous activity in bringing about punishment for violations which in themselves are relatively devoid of serious consequences. Perhaps the greatest difficulty which the conscientious executive has to face is that of relinquishing many duties to his subordinates with the feeling, perhaps, that he can perform them just a little bit better than can some one else. The general manager of a railroad system cannot also be dispatcher and train conductor and the entomological executive must delegate to subordinates many duties which he probably can attend to better than they. The executive himself must some day give way to another and an efficient organization requires that every man in it should be prepared and qualified to step into the place of the man higher up, including the place of the executive himself. Details and routine matters must go to subordinates. If the latter cannot perform these tasks they should be taught; if incapable of being taught they should be replaced by more competent ones. One buried in a mass of details loses perspective. The head of a large working organization not only must not lose perspective; he must have the leisure in which to create a forward perspective and see far beyond the tasks and plans of today.

4. State and Federal Workers in Entomology

This phase of our subject is one which the speaker approaches with some hesitancy. It is a subject frequently discussed by the state workers on the one hand and by the federal workers on the other—but rarely by both together. Because a subject may be considered by some as more or less "delicate" is not necessarily a reason for ignoring it. It may also be a vital subject. Truth is the basis of all perfect understanding and when one knows the facts and motives actuating another in his attitude, a common ground of understanding is shortly arrived at. If the present discussion has any purpose at all, it is that of making a plea for more perfect cooperation and coordination of all the agencies engaged in economic entomological work. At the risk, therefore, of invoking some criticism, the speaker ventures to touch upon what appears to him to be vital phases of the relationship between federal and state workers in economic entomology.

That this relationship is at present by no means ideal will doubtless be conceded by all. By this we do not mean to infer that there is a feeling of antagonism or jealousy between these two groups of workers for such is self-evidently not the case. Rather, these two groups are the victims of circumstances for which they are only in part responsible, if indeed they are really responsible at all. We have already referred,

in our introduction, to the unnecessary duplication of work by these agencies and to the manner in which problems, essentially local in character, are sometimes handled by the federal Bureau of Entomology to the embarrassment or impediment of the state workers. The rapid expansion of the Department of Agriculture has many times resulted in the Department taking up problems, for the common good, in states where the legislatures either could not or would not provide facilities for doing so. There has also been an insistent demand that the federal government assume the role of patron to the end that state legislatures may "conserve" the state funds.

The Bureau of Entomology should function mainly in a regulatory and advisory capacity, should be the "central supply station" for entomological knowledge and council, a clearing house for experimental results and an institution to cope with those problems which involve activities clearly extending beyond the borders of any single state. For the Bureau to establish field laboratories for the study of problems largely or entirely local in character is to draw attention of the public away from the field and activities of the state institutions, to the detriment of the latter. With the inception of a federal laboratory in any locality the growers come to expect greater things from the federal undertaking than can possibly be realized. The publicity attending the establishment and maintenance of such field laboratories or stations creates in the minds of legislators an inclination to let the government solve local problems and they accordingly make this the excuse for not properly supporting their own state institutions. The speaker has in mind the case of a field laboratory established by the Bureau for the study of tobacco insects. The tobacco growers of the State in which this field station is located have come to look upon this station as their only source of information on insects affecting tobacco. They do not apply to their state entomologist for help or information or even to their State Experiment Station or Extension Service for assistance along any line. Consequently they have no interest in their state institutions, their representatives in the legislature have none and oppose appropriations for agricultural work of all kinds and the entire state, including the tobacco growers themselves, suffers the consequences.

It is no more logical for the Bureau to establish and conduct field stations, exclusively under its own management and direction, for the study of a certain insect or the insect enemies of a certain crop, than it would be for the Department of Agriculture to establishment agricultural colleges in competition with those now in operation by the several states, appoint their faculties and direct their operations exclusively from Washington. We do not wish to be understood as contending

that the Department of Agriculture should not conduct research or investigational work. It is necessary for the Department to engage in certain kinds of research work in order that its policies and advice may be based upon accurate knowledge and correct principles but when the investigational work touches directly the agricultural interests or practices of any state, the Department's effort should be through the state institutions and state agencies. Such a course would greatly aid these institutions, would bring added prestige to entomological investigation and would in no wise react to the detriment of the federal bureau. On this aspect of the question permit us to quote from no less an authority than Professor L. H. Bailey:

"... every movement that tends to weaken local responsibility and initiative is a distinct menace to the people Whenever the people are taught to look beyond their own institutions to federal institutions alone, they lose opportunity and power to help themselves. The people and the states are at fault in calling to Congress when they should call first to their legislatures."[1]

One may properly ask: "What is more natural than for the people to look to the federal government rather than to their own institutions when the federal government itself encourages this attitude?"

It will perhaps be said, in reply to these contentions, that many entomological problems must be studied in different states and sections in order that reliable conclusions may be drawn. This is true but the regional data needed can be secured as readily and as cheaply through the state institutions—and frequently will be more reliable—than if secured by special investigators, often unfamiliar with local conditions, sent out from Washington. The objection may also be offered that the federal Bureau must sometimes investigate or otherwise deal with insect problems or outbreaks when the state in which these occur does not provide the funds for doing it, particularly when the insect is one which may presently invade other states. Such instances sometimes involve insect pests of the most dangerous nature, as witness the recent appearance of the Mexican bean beetle[2] in Alabama, and in such circumstances federal help should come quickly and unfailingly.

It would appear that the problem of coordination here presented could be solved by either of three plans: (1) for the federal government to place certain of its funds at the disposal of the state agencies subject, of course, to the conduct of the project and the personnel of those engaged in it meeting the approval of the federal authorities, (2) by the federal government placing its own agents at the service of the state authorities or (3) by federal agents working in close cooperation and

[1]Presidential Address before the Association of Agricultural Colleges and Experiment Stations, May 28, 1907.

[2]*Epilachna corrupta* Muls.

under a uniform plan with state agents, although continuing to be directly responsible to the head of their own Bureau.

In very recent years there has come a new and striking development in entomological practice, that of earnestly attempting the eradication of injurious forms. This definite type of activity is not confined to the entomological field, for numerous campaigns to eradicate plant diseases are under way and veterinarians have demonstrated their ability to successfully prosecute the work of eradicating an animal parasite, the cattle tick. These various eradication projects have been taken up independently by different agencies, both federal and state, without any apparent attempt at coordination and, we fear, with a none too clear appreciation of the principles involved. Whatever these principles may be, they are the same for all eradication projects; the latter differ only in details according to the form or habits of the organism being dealt with. Does it not seem that the time has arrived when the principles underlying successful eradication work should be clearly enunciated and that certain workers should qualify as "eradication experts," regardless of whether the eradication problems involve insect pests, plant diseases, animal parasites or infectious diseases of domestic animals? Perhaps it would be regarded as visionary to suggest that "bureaus of eradication" be established to deal with these projects, but if eradication measures are to attain that degree of success now hoped for such a development will be inevitable. Indeed, Dr. E. P. Felt has already suggested, in his address before the Entomological Society of Ontario on November 17th, the creation of an organization specially qualified to deal with emergencies created by the establishment of new insect pests and that provision should be made in annual appropriations for funds with which to deal with such unforeseen contingencies.

Conclusion

Although the progress of economic entomology has been marvelous and much has been accomplished, the rapid growth of the science has brought about a more or less chaotic condition in that many agencies are operating without proper coordination. One is reminded of a vast army, made up of many units enlisted in the same campaign, but operating with concerted action between certain divisions only and at times even in competition with each other. The next step forward in our profession should be the coordinating and harmonizing of all activities, at least in related fields. Only by such a development, on broad and constructive lines, can economic entomology be made to render the maximum of service and usefulness to the ultimate object of its efforts, namely, the public.

VICE-PRESIDENT GOSSARD: After having listened to this very excellent address from one of the most capable of our members and the head of a large organization, I am sure you will wish to discuss the matter.

MR. W. C. O'KANE: Every one of us here is sitting quietly waiting for the other man to speak first. I would like to do this, too, but I cannot let this opportunity go by without expressing my personal appreciation of President Newell's address. Not every man has the courage of his convictions, and not every man has convictions that are worth putting courage into. He has both. When you listen to an address of this kind you must have the same sort of feelings that I have, that the whole future development of economic entomology is so enormous that you wonder how we are going to undertake it. I never have heard an address in this association that had as much suggestive and constructive work in it. I only wish that it were possible for Mr. Newell to go ahead and develop into concrete plans many of the things he has suggested in his address.

VICE-PRESIDENT GOSSARD: I think most of us have the feeling that President Newell is so experienced along these lines of executive work that we cannot add very much. In fact, so much of his position is fundamentally sound and is sort of axiomatic, that no one feels like adding to it or subtracting from it.

PRESIDENT WILMON NEWELL: We will now proceed to the program. Subject to the approval of the association, the practise concerning papers will be as follows:

The time limit given to each paper on the program will not be extended, except by vote of the association. If the author is not present when a paper is called, the paper will be deferred to the end of that session, and if time permits, all such deferred papers will be called in order, but they will not be carried over to the beginning of the next regular session. Unless the association directs otherwise, papers sent by absent members will be read by title only.

First paper is entitled "A Volunteer Pest Reporting Service," by S. B. Fracker, Madison, Wis.

A VOLUNTEER PEST REPORTING SERVICE

By S. B. FRACKER, *Madison, Wis.*

One of the problems of every entomologist whose field of work includes assistance in the control of insect epidemics is that of securing adequate information in time to be of value. This is particularly true in the case of the less conspicuous insects, although even when outbreaks are so

serious as to result in complete destruction of certain crops, the damage may be extensive before reports are received.

The larger the state and the greater the variety of crops grown, the more serious is this problem. Nevertheless it seems to be a custom in entomological departments to rely on occasional or emergency calls from the farmers and growers affected. The problem is solved to some extent by the establishment of field stations with entomologists permanently located in various parts of the state, but this is beyond the resources of many departments and even when such stations can be established, as they are now in Illinois, each of them has as large a field to cover as two or three of the New England states combined.

It was with the double purpose of being able to assist in the control of insect outbreaks promptly and of securing adequate and permanent records which might at some future period help to solve the problem of periodicity in insect outbreaks and the relation of weather and climatic changes to these conditions, that the Wisconsin Department of Agriculture began the establishment of a voluntary pest reporting service this past season. Somewhat similar plans are in use, I believe, in New York and Tennessee. While the results are adaptable both to immediate use and permanent records, the present paper will be confined to the methods employed and the nature of information secured, rather than to the more practical results in the way of insect control during the current season.

Organization

The methods employed in securing this information were based to some extent on those of the Bureau of Crop Estimates, and the results were in fact correlated with the state work of the latter organization. The Bureau secures reports from the fifty or sixty counties on crop and weather conditions each week. One of the questions asked each correspondent is to name any insects or plant diseases which may be destroying or injuring crops in his vicinity. The reports are of course very brief and entirely inadequate from the entomological standpoint, but are of considerable assistance in determining the localities in which grasshoppers, and, in Wisconsin, the various potato insects are causing the greatest injury.

For the pest reporting service itself a list of probable reporters was worked up from the membership of the principal agricultural associations, such as the grain growers, known as The Wisconsin Experiment Association, the fruit growers and market gardeners in the horticultural society, graduates of the agricultural college who had taken a course or two in entomology, together with selected potato and tobacco growers, lists of which are also available. It was felt that county agents were so

heavily worked that it would be best not to expect continued reporting from them, but information secured in each county, when it would be of value, was sent to the county agent with the names of the farmers or horticulturists giving the information.

As in crop reporting, two types of schedule are sent out. The first requests general information in regard to the insects affecting the principal crops listed in the blank. This results in information concerning a wide variety of insects and is particularly valuable for the field entomologists working on insect epidemics.

When certain insects become numerous or particular kinds of control measures are being tried out in various parts of the state, the second form of report is used, which is a special questionaire relating to a particular insect or control measure. This past season in Wisconsin such a questionaire was used in regard to the prevalance of army worms, the number of farms in the county which suffered loss, control measures most commonly used, and their effectiveness. With this same schedule was included a similar one referring to grasshoppers and another to potato leafhoppers. These special reports may in turn be of two types: one for wide distribution in which suggestions for control can be included and which can well be distributed to every member of an agricultural association or every grower of a particular kind of a crop. The second and more detailed type of special report blank need only be sent to forty or fifty correspondents in various parts of the state upon whose statements regarding dates of injury, adequacy of control, etc., particular reliance can be placed.

The results of the first season's trial in Wisconsin have been at least as good as was expected, but as the list of correspondents is worked over can undoubtedly be improved. The value of such reports for both of the purposes for which the service was established depends entirely on three points: First, whether the reports are received from a sufficient number of widely distributed growers; second, whether they are accurate and complete enough to be of value, and third, whether they are received with sufficient promptness for quick action.

The general reports asking for information on grains, potatoes, other farm crops, truck crops, orchards and small fruit were returned from forty-five out of seventy-one counties of the state. If we add the general information secured through the crop reporting service with respect to the common insects, we find that sixty-two of the seventy-one counties sent in information regarding pests.

A most valuable suggestion received from the Bureau of Crop Estimates was that of dividing the list of reporters and sending blanks on alternate weeks or fortnights. If there are four correspondents to the

county, a blank can be sent to one each week. The result is a series of weekly reports while each correspondent makes one out only once a month.

While the entomological report form did not refer to plant diseases, a considerable number of reports were received concerning rusts, smut, potato blight, and fire blight in apple trees, as well as occasional reports regarding other plant diseases. The reports in regard to rust are of particular interest with respect to the accuracy and promptness which can be expected. The first week in which rust was referred to by the correspondents sending crop reports, such information came from five counties confined almost entirely to the southern border of the state. The next week seven additional counties were included, only two of which were north of the center of the state. A week later, of the seven counties reporting outbreaks of rusts, five were in the extreme northern part of the state. This was followed by a series of weekly reports in which no reference to grain rust was made as harvest had been completed. The reports of the grasshopper epidemic were somewhat similar, altho the progress from south to north was not a feature of the grasshopper outbreaks, the epidemic being confined largely to the northern half of the state.

In all, twenty-five insects and half a dozen plant diseases were reported. Those of general farm crops were the grasshopper, armyworm, and cutworm epidemics, and the usual annual injury from white grubs, wheat-joint worms, and wireworms. In the case of both armyworms and grasshoppers immediate and timely assistance can be given. For the other insects the information was of greater permanent than immediate value.

Of potato insects the Colorado potato beetle was of course reported everywhere from June to the middle of August. Leafhoppers were reported in about fifteen counties, the counties being grouped from week to week in almost the same way as those reporting rust outbreaks. Flea beetles were reported more rarely.

Of the insects reported attacking fruit, namely, the codling moth, the plum curculio, cherry slug, and canker worm, the most interesting was the cherry slug which appeared for the first time in a commercial cherry producing section (Bayfield county) and did a great deal of damage. Most cherry orchards in the county had never been sprayed with arsenate of lead, as it was not necessary until this season. No representative of the department being in that vicinity, adequate assistance and information would probably not have been available to the large number of cherry growers in time if it had not been for the pest reports which began to come in at the very beginning of the attack by the slugs.

Of the smaller and less prominent crops, the following insects were reported and in each case an outline of the best developed control measures were sent to the reporter.—Strawberry weevil, crown borer, and leaf roller; pea aphis, turnip aphis, and melon aphis; onion maggot and onion thrips; cucumber beetles, cabbage worms, and corn ear worms.

With respect to accuracy and reliability, the reports vary, but considerable confidence could be placed in them in the case of the more conspicuous forms of injury. The tabulation of data from three different sources, namely, the crop reporting service, the newly established pest reporting service, and the work of the field men of the department showed that information from the three sources tallied very closely.

Omissions of serious insect injury were rare, only one case being of great importance. This was a cankerworm outbreak covering a couple of townships. As the cankerworms had practically disappeared by the time the first report blank was sent out, this omission is not surprising.

With respect to the promptness with which reports of insect and disease attacks were received, the principal value came in the case of progressive and long continued losses, such as those from grasshoppers and grain rust, for army worm attacks are usually so sudden, brief, and destructive in Wisconsin that reliance must be placed on county agents for control. They are the only ones who can reach the scene of the damage in time.

The cherry slug reports from Bayfield county mentioned above were fortunately received just at the beginning of the attack, a condition under which maximum assistance could be given.

The great need in work of this kind and the principal reason why pest reporting has scarcely ever been undertaken systematically is the lack of any adequate means of measurement of the injury. This problem has not been solved as yet and perhaps will not be.

If such a pest reporting service could be organized on a national scale, with the establishment of permanent records, a means of studying serious insect losses would be established which is not at all available at the present time. It is generally understood, for example, that extensive armyworm outbreaks have not occurred between the years 1900 and 1920 and that the present grasshopper outbreaks in the northern states have been threatening for about three years, but there are no official records from which a future student of problems of insect outbreaks will be able to secure such facts. The only insects upon which such data has been accumulated which could be used for this purpose so far as the writer has information are the chinch bug and the Hessian fly, and even in these cases they are not as complete as could be desired.

Within the state systematic pest reporting from all sections offers additional advantages in enabling immediate action to be taken by the entomological staff in the case of insect injury about which they have no previous information. It also enables them to send outlines of the life histories and control measures of the common insects to representative growers in every county, a feature which will result in as extensive and desirable a form of entomological education as could be worked out.

PRESIDENT WILMON NEWELL: Is there any discussion?

MR. E. P. FELT: I believe a volunteer pest reporting service is of material value in assisting in the detection of recently introduced insects, though I cannot support this by facts. About 20 years ago, the speaker had a similar service and two of these voluntary observers, as we called them at that time, are now active, energetic entomologists. I do not know whether they started with the voluntary pest service or not, but one of the things that we need to develop throughout the country is a more general appreciation of scientific work and more general cooperation, not only on the part of entomologists, but agriculturists, foresters, and laymen in general. We must secure the sympathy and cooperation of the latter, and in doing that, we will immensely increase our efficiency. I believe this is an activity that has not been given sufficient attention in many places.

MR. W. E. HINDS: I would call attention to the Mexican Bean Beetle situation in Alabama as an instance where a voluntary pest reporting service failed. This insect came to the attention of a county agent in Alabama a year before it was reported to the Experiment Station, because he failed to appreciate its importance. He recognized the insect and had some printed information concerning it, but failed to report.

MR. W. R. WALTON: I have had considerable experience with voluntary crop pest reporting service. A great many of the Federal reports are received in the Bureau of Crop Statistics and are referred to our office. They are usually 30 days late and do not give information quick enough to be of material use.

PRESIDENT WILMON NEWELL: The next is a joint paper by H. A. Gossard and T. H. Parks, on the "Value of Entomological Service to the Ohio Farm Bureaus in Their Efforts to Control the Hessian Fly."

HESSIAN FLY PREVENTION

By H. A. GOSSARD and T. H. PARKS

For many years, the standard recommendation of entomologists to prevent Hessian fly injury has been to seed late. All have assumed the advice to be good and Hessian fly has been cited perhaps, more frequently

than any other insect as an illustration of what can be done by adapting agricultural practice so as to strike at the weak point in an insect's life history.

During the past few years, some entomologists have inquired somewhat further and have tried to find safe seeding dates for the different sections of our nation, basing them on the average dates determined through a series of years on observation plots seeded on different dates. However, for several years, some of the Ohio entomologists have greatly distrusted for fly prevention, the reliability of the seeding dates commonly depended on to secure a maximum yield and also to escape fly damage. They have, therefore, sought to find some more certain method of putting the young wheat beyond the reach of flies which sometimes decline to obey the schedules made out for them by the entomological brotherhood. The method devised has been used quite successfully during two different seasons to determine the best dates, but does not seem to promise constant and uniform success. Supplemented by the judicious use of other known methods it bids fair to prove valuable.

To discover the gradual approach of a Hessian fly outbreak has engaged our attention. Few entomologists in the field have had the opportunity and facilities to study this phenomenon and thereby obtain sufficient knowledge to certainly predict the visitation and hence, prevent it, or curtail in part the losses it would cause. The entomological workers of Ohio through the Annual Wheat Insect Survey, have determined such a means of forecast and have successfully used it to foretell and greatly to reduce the most serious outbreak the state has experienced for many years; viz, that of the fall of 1919.

Preliminary Work of 1919

In the summer of 1917, the Ohio Experiment Station, as a war activity, organized the wheat survey. So much of promise seemed involved in its continuance, that each year since 1917, all of the entomological workers of Ohio State institutions have been called together to make the Wheat Insect Survey, the general direction of the work being shifted from one to the other of the State Entomological departments according to convenience. In July, 1919, this practice resulted in detecting the presence of the Hessian fly in threatening numbers. Since a progressive development of the pest was clearly indicated by the data gathered by this and the preceding surveys, a campaign for "safe seeding" was at once organized by the Extension Entomologist. This was conducted through farm bureaus and local, county, and state papers, circular letters, posters and community meetings, the effort being specially centered on northern Ohio. The seeding dates recommended were

those which had been generally accepted by our entomologists and agriculturists as safe in previous years.

Result of the Late-Sowing Campaign of 1919

In the northern counties, probably nearly eighty percent. of the growers waited for the suggested dates before sowing. In the central and southern counties, about ninety percent. of the growers in counties having farm bureaus waited for the proper dates. The wisdom of this was seen in November, by which time the early sowed wheat all over Ohio had been destroyed by a very heavy fall brood of fly. Those who sowed before the dates suggested, everywhere suffered heavy and sometimes total loss. This is well illustrated by the yields obtained from the "date of sowing" plats on the Miami County Experiment Farm, which are here given:

When Sowed	Percent. of plants infested Nov. 1919	Yield in July 1920
Sept. 8	100	16.5 bu.
Sept. 16	100	18.5 "
Sept. 23	100	12.5 "
Sept. 27	55	27.0 "
Sept. 29	10	37.4 "
Oct. 2	0	40.0 "
Oct. 4	0	37.8 "
Oct. 13	0	36.1 "
Oct. 20	0	21.6 "

The seeding dates proved generally trustworthy for southern Ohio but not for northern, where wheat was damaged if sown as late as September 26, or eight days later than recommended. By November, it was determined that there was a range of only five days in the departure of the fall brood from Lake Erie on the north to Cincinnati on the south, instead of 14 days, as should be the case, if it had obeyed the law of latitude. In southern Ohio less than 10 percent. of the wheat became infested, but 80 percent. is our estimate for several northern counties.

Preliminary Work of 1920

During July, 44 counties were visited by the surveyors and the distribution of the spring and summer damage was found to conform to the previous fall infestation. The area of greatest density of infestation had moved from north-central to north-western Ohio. In one county, eighty-nine percent of all straws had been killed or damaged by the fly. On many of the best farms in northern Ohio the average wheat yield was not over eight bushels per acre, where in other years yields of 35 bushels had frequently been obtained. Many wheat fields were cut for timothy.

The survey showed that 44 percent. of all straws examined in the state were either killed or damaged by fly. Material was collected in

each county visited and sent to Wooster and to the Field Laboratory of the Bureau of Entomology at Lafayette, Indiana, to be examined for parasitism. No particular section of the state was found to be favored in the distribution of these parasites.

By August first, we were sure that the state was again threatened by serious fall damage, and another campaign of late sowing seemed necessary. This time it was not necessary to solicit the interest of the county agents nor of many of the farmers. The question most frequently asked was: "When shall we sow?" Uniform sowing dates had been decided upon by the entomologists working on this problem in Illinois, Indiana and Ohio, and these were given wide publicity in Ohio as the probable safe dates to sow to avoid both Hessian fly and winter-killing.

To supplement the sowing dates and better guide the growers of northern Ohio past the expected damage from the fall brood, the three entomological departments of Ohio arranged to establish three field observation points where the daily emergence and egg-laying could be watched during September. It was hoped in this way to be able to hold back sowing until the danger of the brood was past, if the dates previously chosen were again too early. To explain this plan, and also organize the counties in the worst infested area, the Extension Entomologist, during August, met with the crops committees of the farm bureaus in 19 of the north-western counties, as it was thought best to let these committees take the lead in the campaign work in their counties. A "fly meeting" was held in conference with these men, who at these meetings chose the earliest date they wanted any wheat sown in the county and outlined their plan to prevent wheat being sowed early this year. The county agents of these counties were instructed to keep in touch with the records from the rearing cages and egg-laying counts that were to be made by the entomologists, and have the organizations in readiness to further postpone the sowing dates if necessary. The committees in these counties conducted their own campaign. This was done through circular letters, meetings, daily press items, posters, and rubber stamps used on the mail of county firms doing business with farmers. Eight county agents had attractive exhibits of adult Hessian flies at County Fairs while the University featured this at the State Fair.

Method for Discovering the Seeding Date

In the Journal of Economic Entomology, February 1916, pp. 142–144 a description was given of a new method used to determine the seeding date, and it will be remembered that Miami County, Ohio, was almost wholly freed from Hessian fly by one season's work. Substantially the same method was followed this season, but we endeavored

to make our breeding stations perform a statewide service and added some new types of cage or trap to either breed out flies or else to catch them in natural flight in the field. The three most practical were named and defined as follows:

1. Concentration cage. This was a tight store box without bottom and with circular holes cut in the top for lantern globes fitted into them, the globes being covered over the top with cheese-cloth tied in place. Into this cage was put about two bushels of stubble and surface earth known to contain healthy "flaxseeds" in great numbers. If the stubble and earth heap was not moist, this was or should have been wetted with one or two pailsful of water, because this loose heap dries out more rapidly than field soil, and normal conditions are more nearly preserved by adding the water. Water was also added as each rain occurred.

2. Migration wire. Five linear feet of ordinary wire fly-screen, two or three feet high, was set up on a frame with the lowest edge elevated about eight inches to one foot above the ground and standing north and south. A similar trap was set at right angles to it, east and west. By this arrangement the chance for catching flies was equally good no matter from which direction the wind blew. The wire was coated with tanglefoot, the flies removed with a brush after each day's count, and the tanglefoot renewed or freshened by brushing over it.

3. Egg Record. Besides the traps just described, a strip of wheat was seeded at each station in time to be of inviting size at the date when the flies were expected to appear. A number of these plants were so marked that they could be identified easily, and when the flies began to appear all eggs were counted and removed. Each day, thereafter, the eggs were counted and removed.

The records of fly activity at one of the four stations were registered by these devices as follows:

HESSIAN FLY RECORD * * * 1920, SANDUSKY, OHIO

	September																				Oct.
Dates Kind of cage	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1
Concentration	3	2	4			6	10	11	34	87	129	161	152	72	76	43	18	37	2	0	1
Migration ..									2	127	201	268	99	65	44	82	48	38	8	3	0
Totals	3	2	4			6	10	11	36	214	330	429	251	137	120	125	66	75	10	3	1
Eggs counted on 100 plants						192	66	96	37	475	1247	1577	458	193	253	158	69	34	24	10	

While stations were also maintained at Bryan, Wooster and Columbus, the brood at the last two points was much lighter and results were not pronounced. For these two points, we were obliged to fall back on

our old seeding dates, but felt more sure of them after having the data from Bryan and Sandusky. We found that for the successful management of an emergence station the entire time of one entomologist is required.

We had meetings at both Bryan and Sandusky of farmers and county agricultural agents, and after showing them our equipment and the results, agreed with them on seeding dates. While the migration wire and the egg counts seemed to give the truest record regarding the activity of the brood, the concentration cage was the best asset from a psychological standpoint to gain the attention and support of the county agents and farmers. When they could see a swarm of flies which had emerged within the preceding 24 hours in the glass globe, and found this record supported by egg counts and the catch of the migration wire, they were readily convinced that wheat exposed to attack would certainly suffer. The other types of cage gave valuable information regarding density of emergence and furnished a check on the concentration cage, the migration trap and egg-laying records. From them we knew that emergence in the concentration cage was nearly normal, not lagging more than a day or two behind that in the cages with field conditions.

After the experience in Miami County in 1915 and this season's experience, we feel confident that if, in years of Hessian fly abundance, a half dozen competent entomologist are stationed at six fly-emergence stations in selected localities over our state, we can determine from their observations favorable seeding dates for different sections with about as much certainty and precision as the United States Weather Bureau can predict the weather. While some of the records may prove indecisive, others are likely to give a clear record, assisting greatly in determining the trustworthiness of the seeding dates usually followed. We concede that the date, thus found, may be a few days later than the best date for maximum yield, but this latter can hardly be established for years with heavy infestation, and we, therefore, favor finding the safest date it is possible to discover.

Result of Late Sowing Campaign of 1920

The daily emergence and egg-laying records were wired or mailed to the county agents in the counties it was desired to guide, and it was found necessary to delay seeding several days longer than the dates at first selected to sow by some of these county farm bureaus. On September 25th, the emergence and egg-laying had subsided greatly at Bryan, and two days later at Sandusky. Analyses made of "flaxseeds" in the old stubble showed that most of the flies had emerged.

A considerable number, which had not emerged, contained Hessian-fly larvae which apparently would not emerge until spring. The word was given to Williams and surrounding counties to sow wheat after the 27th. For Erie and surrounding counties, October 1st was the date selected. On September 28th, many drills were starting in the north-western counties, though some chose to wait a little longer.

The result of the extension effort was indeed gratifying, and the response almost unanimous. Less than one percent. of the wheat had been sowed before the final dates chosen. In many townships not an early sowed field could be found. Seeding proceeded promptly during the first ten days of October. At no point were many Hessian-fly eggs found from September 30th until October 14th. The young wheat had escaped a very heavy infestation and was looking well. The little early-sowed wheat that could be found, in most counties, had become heavily infested with the fall brood soon after it came up.

October Egg-laying

An unexpected appearance of adult flies during mid-October over all except north-eastern Ohio, resulted in many eggs being deposited between October 14th and 19th. This emergence was over by October 20th. Wheat which came up too late to become infested by the main fall brood, then became infested with eggs, and later with the maggots of the fly. At Columbus 802 eggs were deposited upon 100 plants kept under observation during that time.

Proof was obtained that this late wave of emerging adults came from flaxseeds which developed during June on the main crop. Hence they did not represent a true supplementary brood, but came from "hold-over" flaxseeds which did not give up their occupants during September as previously observed. This "holdover" stock of summer flaxseeds was exceedingly large, and only a part of them gave up adult flies during October. The remainder are carrying their occupants, doubtless to enhance the numbers of the spring brood. Instead of emerging in September, the fall broof of 1920 divided into three parts as follows: 1—September emergence of the normal fall brood. 2—Mid October emergence or "late wave." 3—"Carry over" flaxseeds still unemerged in midwinter.

The maggots which hatched from the eggs deposited by the late wave adults grew quite slowly, and caused some damage to all wheat above ground before October 16th. About 20 percent. of these plants became infested.

Thus, by an eleventh hour effort, the Hessian-fly prevented what looked to be a complete and statewide control as the result of the united

effort of the growers. The damage from the late wave of October flies is considerable, but insignificant when compared with the result of the visitation of the main fall brood of 1919, the like of which the farmers of Ohio missed in 1920 by pulling all together.

SUMMARY

Summarizing the Ohio work we believe we are justified in claiming:

First, that an annual entomological wheat survey just before harvest, such as Ohio has maintained for four seasons, will reveal an approaching outbreak of Hessian fly and prevent surprise.

Second, that several fly emergence stations located at selected points over the state will furnish the most dependable data obtainable upon which to base recommendations for safe seeding dates for the different localities. If some or all of the emergence stations fail to yield decisive results, the sowing dates established by plot tests through a series of years should be used to guide the sower.

Third, that a well organized extension service cooperating with the county farm bureaus can get the recommended dates for seeding into the hands of the farmers within 24 hours or less after they are determined from the emergence records. And, futher, that by energetic preliminary work the Extension Entomologist can secure the ready cooperation of 99 percent. of the farmers in a seeding campaign.

Fourth, that as a result of our annual surveys and correlated efforts, a threatened heavy brood of fly has been kept suppressed, and that there will be twice as many bushels of wheat in Ohio in 1921 as would have been the case, had we given the insect no attention.

MR. W. P. FLINT: The experiences stated in this paper are about the same as those we have had in Illinois this year, particularly concerning the great variation in the actual fly-free dates. From 1918 to 1920, the dates varied 22 days at Champaign, Ill.

MR. J. J. DAVIS: My recent observations in southern Indiana indicate that the late wave of fly is still in the larval stage and very likely these larvae will not mature and not issue next spring.

MR. T. H. PARKS: The change from the larva to the flaxseed stage in Ohio has been very recent. Three weeks ago there were very few in the flaxseed stage in southern Ohio, but now over half of them are in that stage.

MR. H. A. GOSSARD: Three-fourths of them are in that stage in northern Ohio.

PRESIDENT WILMON NEWELL: The next paper entitled "The Potato Leafhopper and Tarnished Plant Bug in 1916," will be presented by Mr. S. Marcovitch.

THE POTATO LEAF-HOPPER AND TARNISHED PLANT BUG IN 1916

By S. MARCOVITCH, *Knoxville, Tenn.*

Ball records in this JOURNAL a severe epidemic of the potato leaf-hopper on potatoes in Wisconsin for the summer of 1918. In a series of splendid experiments he also proves that the causative agent is the potato leaf-hopper, *Empoasca mali* Le B., and not the so called tipburn.

The writer had reached the same conclusion during the summer of 1916 when connected with the Minnesota Experiment Station. The results were published in the Princeton Union August 24, 1916, describing "havoc in the potato fields," in the vicinity of Princeton. Minnesota. Mr. Saxon a potato farmer in Princeton, called our attention to the hoppers. It was only his insistence that the bugs were the cause of the damage, that caused more accurate observations to be made. As far back as 1911, Mr. Saxon reports that he noticed the leaf-hoppers injuring his potatoes, causing as much as 35 per cent. damage. Several weeks in the field were devoted to studying and experimenting with hopper-dozers and spraying.

In Minnesota, the Triumph variety suffered most severely. The leaves were dying so rapidly that a perceptible decaying odor could be smelled. From 350 to 500 leaf-hoppers and about 50 tarnished plant bugs were counted on a single vine. In addition to the regular potato leaf-hopper, *Empoasca mali*, there were also present in some numbers two other leaf-hoppers, *Deltocephalus inimicus* and *Cicadula 6-notata* as well as a large brown *Drosophila*, probably attracted by the decaying odor. It was noted that the leaf-hoppers suck on the small veins causing the leaf to curl along the margin while the tarnished plant bugs suck on the midrib or the tip of the growing shoot causing the leaf to curl upwards or the shoot to wilt entirely. If the stem of a shoot that has been stung by the tarnished plant bug is cut open, it will be found to be rotten. Very often a distinct swelling can be noted on the stems. Later varieties, such as the Burbank, did not suffer badly probably because they are not so tender as the Triumph, or as Ball observed that not enough foliage is present for egg deposition of the spring brood. During the early part of September wet rainy weather set in. The leaf-hoppers promptly disapppeared and many were noticed clinging to leaves, having been attacked by a fungus. Observations were made on early Ohios in the western part of the state in the vicinity of Moorhead. No burning was found and but very few leaf-hoppers were noticed. The season was wet there and this probably accounts for their absence.

The work in regard to the control consisted in running a hopper-dozer over 20 acres of potatoes. Both kerosene and tanglefoot were

used for the catching mediums. A great many leaf-hoppers were caught but figuring 400 to a plant we caught probably one percent. The hoppers would fly over the machine and under and at times the driver could hardly see his way thru the cloud of insects dancing over the machine. Our work, at best, demonstrated the utter uselessness of the hopper-dozer for the control of the potato leaf-hopper.

Spraying experiments were also carried out using kerosene emulsion. A 15 to 1 emulsion gave no results, neither did a 10 to 1. The only thing we could get to kill them was a 2-to-1 or pure, kerosene. The latter two did not injure the vines. When Professor Moore learned that we had used pure kerosene without injury to the plants, he set out to determine the cause and gave us his results (JOUR. ECON. ENT. 11:70) showing that kerosene is a very variable product in regard to boiling points and toxicity.

It was planned to make further cage experiments such as Ball did to prove absolutely and beyond doubt that the leaf-hopper is the cause of the burning of the potato leaves, but the writer left Minnesota to enter another field shortly afterwards.

PRESIDENT WILMON NEWELL: The next three papers bear on the same subject. If there is no objection, discussion will be deferred until their reading has been completed.

The first is by Mr. Albert Hartzell on "Further Notes on the Life History of the Potato Leafhopper."

FURTHER NOTES ON THE LIFE HISTORY OF THE POTATO LEAFHOPPER

(*Empoasca mali* Le Baron)

By ALBERT HARTZELL, *Iowa State College, Ames, Iowa*

Dr. Ball's[1] discovery that the potato leafhopper is responsible for the disease called tipburn was the first step in removing the subject from conjecture and directed serious attention to the study of the insect as the key to the solution of the problem. Little was known regarding the life history of this species because of the difficulty experienced in keeping the adults and nymphs in captivity a sufficient length of time to rear a complete generation. For the last two years the Iowa Experiment Station has been conducting a study of this insect and as some of the first year's work has been published[2] it is the purpose of this discussion to give only a brief summary of additional information obtained during the growing season of 1920. The work was done under the direction of

[1]Ball, E. D., Wis. Dept. Agr., Bull. 23, pp. 76–102, 1919.
[2]Fenton, F. A., and Hartzell, A., JOUR. EC. ENT., Vol. 13, No. 4, pp. 400–408, 1920.

1, Swelling on stem caused by the tarnished plant bug; 2, Leaf curled along midrib caused by the attack of tarnished plant bug; 3, Leaf showing midrib dying, caused by tarnished plant bug; 4, Stem gnarled as a result of many punctures of the tarnished plant bug.

Dr. F. A. Fenton to whom the writer is indebted for suggestions and criticisms. Mr. I. L. Ressler and Mr. Carl Knapp assisted in conducting some of the experiments.

METHODS

Because of its small size, protective coloration and activity, the potato leafhopper required the development of special technique in order to keep the insect under observation for a sufficient length of time to determine its life cycle. The cage that proved most successful in our work consisted of a large lantern globe with the top covered by means of a very fine screen (20 meshes to the inch) soldered on a galvanized collar made to fit tightly against the top of the globe. By plugging the rim with cotton a very tight and serviceable cage could be had and since the cage was large enough to cover a whole potato stalk it approximated field conditions better than any other device we were able to use. The lantern cages were placed in an out-door shelter which was similar to those used generally in life history work and the results checked up with field observations and experiments.

As the adults are very small and active, difficulty was experienced in transferring them from one cage to another in order to supply them with fresh food plants. To alleviate this a special dark room was built provided with a small window tightly screened. In order to make the darkness more intense the walls were painted black. If lost in transferring, the adults could be recovered because they are positive phototrophic. By means of this device it was possible to make frequent transfers without undue loss of time and the minimum danger of the adults escaping.

CLIMATIC FACTORS

The season of 1920 was unusual in that the average temperature was considerably lower than normal. The maximum temperature at no time exceeded 95 degrees F. at Ames, while during the previous summer a constant high average was maintained from the middle of June until the first week in August with the maximum reaching as high as 100 degrees F. The summer of 1919 was dry and hot as contrasted with a cool, late season this year. The fore part of the season was at least three weeks later than last year and the low average temperature was unfavorable for the development of the leafhoppers. That the insect reaches its optimum development during hot, dry weather has been noted by other workers and was in evidence this season by the large number of adults and nymphs appearing during the last week in July.

SEASONAL HISTORY

The potato leafhopper overwintered in the adult stage. A few females were found early in May on curly dock and other weeds. In

spite of the fact that practically no males were captured at this early date, the females were fertile and ready to lay eggs. This was brought to our attention by the appearance of first instar nymphs on early planted potatoes June 15, indicating that oviposition was under way by the first week in June. The spring flight occurred June 27, which was three weeks later than last year. Prior to this the females greatly out-numbered the males but after the flight the sexes were approximately equal. The early appearing females completed egg laying and died the first week in July, while individuals captured at the time of spring flight continued to live until the first week in August. One over-wintering female died August 27 after having spent 59 days in captivity.

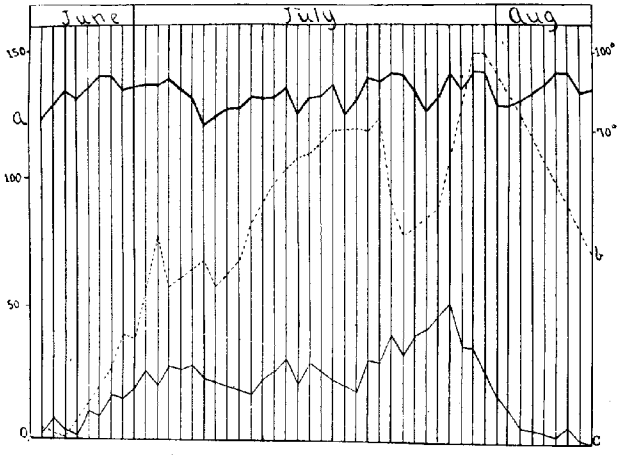


Fig. 1. Curves showing leaf-hopper population correlated with temperature: *a*, Maximum temperature at Ames; *b*, Adults; *c*. Nymphs.

The number of young produced by the early appearing individuals was approximately one-half the number produced by females captured at the time of the spring flight. The nymphs of the last appearing females reached maturity at a correspondingly late date. These observations and experiments convinced the writer that the overwintering females represented a mixed population. The females appearing out of hibernation early in the spring were probably the remnant of the summer generation of the previous season that had emerged too late to complete egg laying and had survived the winter to finish it this year. The absence of males in the fore part of the season and the low fecundity could be accounted for in this way. On the other hand it would follow that the adults appearing at the time of the spring flight were individuals

of last year's second generation, the males and females of which are able to survive the winter in equal proportions.

Adults of the summer generation emerged during the first week in July from nymphs reared from early appearing females, while nymphs hatched from eggs laid by females at the time of the spring flight did not reach maturity until the middle of the month. Adults of the second generation emerged about the middle of August.

With the exception of the overwintering individuals all the females used in our experiments were reared from nymphs so that the generation to which they belonged could not be open to question. The life cycle this season consisted of one complete generation and a partial second. The lateness of the season, the cool, rainy weather during May and June were contributing factors in retarding the development of the leafhopper this year. Experiments conducted by Dr. Fenton under control temperatures indicate that the potato leafhopper requires a very high average temperature for optimum development. Field counts of nymphs indicated that the number of leafhoppers appearing this year was probably a little more than half the number hatching last year. The killing frost this season occurred earlier than last year but was followed by a period of warm weather and the summer generation females continued to oviposit until the middle of October.

Leafhopper Population

In order to obtain an index to the number of adults on the potato vines on a given date, sweepings were made daily throughout the season. A plot of Early Ohios was selected which was not sprayed so that it represented normal conditions. In making the counts an ordinary insect net was used. Twenty strokes of the net were made while walking along the rows and the number of adults captured were counted. In order to reduce the error to a minimum these counts were made by the same person, and the weather permitting, at the same hour daily. The results of the field counts show that the overwintering adults appeared in maximum numbers the first week in July, from that time on the steady rise in the curve is due to the overlapping of the summer generation. By the last week in July most of the overwintering adults had died.

Field counts of the number of young hatching each day were made on early potatoes. Six branches from as many hills were selected and labelled and the number hatching daily were counted and killed. A total of 1077 nymphs hatched on the vines and the possible number per acre would run between five and six millions. The maximum number of nymphs hatched the last week in July indicated that the largest number of eggs were laid during the middle of the month. The field counts

were discontinued in August because by that time practically all the plants were dead from tipburn.

Summer generation adults did not appear in any numbers until the last week in July when they migrated to the late potato fields where they began depositing eggs. Careful field counts of the number of young hatching were made, but the second brood was insignificant as compared to the first. The development of this generation was no doubt influenced to some extent by the death of the vines during the latter half of August. The remaining adults migrated to curly dock where they remained until frost. Nymphs in all stages were found on curly dock as late as October 28, when a freeze occurred in which all of the nymphs and most of the summer generation adults perished. After this host failed them the remaining adults entered into hibernation.

LONGEVITY

That the overwintering adults live longer than was supposed is shown by the fact that the females lived an average of 36 days in captivity, depositing eggs as late as the last week in August. This would indicate a total length of life of at least twelve months.

TABLE I.—CAGE RECORDS OF OVERWINTERING FEMALES CAPTURED PRIOR TO THE SPRING FLIGHT

	Date Female Introduced	Date of Death	Days in Captivity	Average
1	June 19	July 15	26	
2	June 18	July 6	18	
3	June 10	July 6	26	
4	June 17	July 6	19	
5	June 17	July 6	19	21.6 days

A comparison of Tables I and II shows that the females introduced after the spring flight lived much longer than those captured early in the season.

TABLE II.—CAGE RECORDS OF OVERWINTERING FEMALES CAPTURED AFTER THE SPRING FLIGHT

	Date female introduced	Date of death	Days in captivity	Average
1	June 29	Aug. 27	59	
2	June 29	Aug. 9	41	
3	June 29	July 29	30	
4	June 29	July 20	21	
5	June 29	July 29	30	36.2 days

Contrary to the general belief all the females of the summer generation are not killed at the time of frost. One female of this brood lived from August 3 to December 6, a period of 124 days, while the average longevity of five individuals was approximately 100 days. The results of this year's study indicate that some of the females of the summer generation overwinter.

TABLE III.—LONGEVITY OF SUMMER GENERATION FEMALES

	Date female emerged	Date of death	Length of life in days	Average
1	Aug. 3	Dec. 6	124	
2	July 10	Oct. 27	109	
3	July 29	Oct. 30	93	
4	July 7	Oct. 8	93	100.4 days
5	July 7	Sept. 28	83	

OVIPOSITION

Owing to the minute size of the egg and its concealment in the plant tissue, it is impossible to make egg counts. In order to determine the number of fertile eggs, potato plants were exposed to females for seven day periods and the number of nymphs hatching noted. The plants used in this experiment were grown in the greenhouse where they had been free from exposure to leafhoppers.

From June 21 to September 6, for a period of seventy-seven days first generation nymphs were hatched from eggs deposited by overwintering females. Nearly twelve weeks elapsed from the time the first nymphs hatched until the last ones appeared in the cages from these overwintering individuals.

TABLE IV.—NUMBER OF NYMPHS HATCHED FROM EGGS DEPOSITED BY OVERWINTERING FEMALES CAPTURED AFTER SPRING FLIGHT

	Date introduced into cage	First nymph	Last nymph	No. days from 1st to last nymph	Total nymphs
1	June 29	July 8	Aug. 12	35	62
2	June 29	July 8	Sept. 6	60	142
3	June 29	July 7	Aug. 9	33	66
4	June 29	July 8	Aug. 7	30	107
5	June 29	July 8	Aug. 18	41	62

The females introduced into the cages prior to the spring flight averaged 34 nymphs, while those introduced after the flight average 88 nymphs. It appears that the early appearing females had laid part of their eggs the previous summer before going into hibernation. The maximum number of nymphs reared from eggs deposited by a single individual was 142. This record was obtained from a female captured at the time of the spring flight. This female also holds the longevity record for overwintering individuals, living until August 27.

The early appearing nymphs of the summer generation hatched in our cages July 30 but did not appear in any numbers until the middle of the month. The last nymph of this series hatched October 22 but young were collected on curly dock as late as October 28. Thus the oviposition period extended from the middle of July to the middle of October for this season. The greatest number of nymphs reared from eggs deposited by a single female of the summer generation was 59 as

compared with 142 nymphs reared from a single female appearing at the time of the spring flight.

Experiments were conducted to determine what time of the day the eggs are laid. Potato plants in large pots were exposed daily during the egg laying season and a careful count of the number of nymphs hatching noted. The plants were carried to a near-by potato plot and left there for twelve hour periods. When not in use they were kept free from exposure to the adults. Plants exposed from 5 p. m. to 9 a. m. hatched the greatest number of nymphs, which indicated that oviposition occurs for the most part at night.

Host Plants

In order to determine whether or not a complete generation could be reared on some of the plants upon which *Empoasa mali* had been observed feeding, a number of experiments were conducted with curly dock (*Rumex crispus*), Carolina poplar (*Populus alba*), pig weed (*Chenopodium album*), and broad leaf plantain (*Plantago major*). All of the above gave negative results except curly dock from which a complete generation was reared. In addition to curly dock the potato leafhopper has been bred on apple, bean and potato. The writer has collected nymphs from Carolina poplar, sumac (*Rhus hirta*), rhubarb, hollyhock and dandelion. It is possible that the adults feed somewhat promiscuously and may oviposit in plants that are unable to sustain the young, but the supposed long list of host plants may have to be reduced. Strangely enough we have never collected nymphs from broad leaf dock (*Rumex obtusifolius*).

The importance of curly dock as a wild host was brought forcibly to our attention by the death of the late potato vines in August. Adults and nymphs were found on these plants until frost and it is probable that this host may serve as a connecting link between late potatoes in the fall and early potatoes in the spring. The plant affords a very succulent growth and is one of the earliest to appear in the spring and is very resistant to frost. The importance of this weed as a host plant is worthy of further study.

President Wilmon Newell: The next paper is by Mr. John R. Eyer, on "The Influence of Leaf-hopper Control on Potato Yields."

THE INFLUENCE OF LEAF HOPPER CONTROL ON POTATO YIELDS

By J. R. EYER, *State College, Pa.*

During the past two years comparative tests of different insecticide and fungicide combinations have resulted in the conclusion that Bordeaux Mixture with excess lime or other materials to form a wash of heavy consistency, with or without the addition of Nicotine Sulphate, is most effective in preventing the phenomenon known as "Hopper burn."

In Wisconsin, Ball and Dudley obtained satisfactory results with Bordeaux and Bordeaux-Nicotine sprays. In New York State, Parrott and Olmstead have controlled hopper burn by Bordeaux-Lime washes, although some foliage injury resulted from these heavy lime sprays.

Dr. Ritzema Bos, experimenting in Holland, demonstrated the reduction of potato foliage-burning by Bordeaux-Lime sprays, and also noted an appreciable decrease, during cloudy seasons, in the tuber production of sprayed plants. His experiments support the conclusion that, during sunny periods, the Bordeaux Mixture has a beneficial effect on healthy plants due in a large part to the shading it produces. During cloudy seasons, however, this shading decreases the potato yield.

This paper presents the details of two years experiments, conducted under field conditions in Erie County, Pennsylvania. These tests were made with especial reference to the control of hopper burn, and to the effect of such sprays on tuber production. It is interesting to note that there were but thirty-six sunshiny days in Erie County during the potato growing season of 1919 and forty-five during the season of 1920. According to Professor Muncie, our Pathologist, late blight did not factor in the results of the spraying experiments for either season.

The experiments of 1919 indicated that Bordeaux Mixture produced a fair control of hopper burn and increased the yield twenty-nine bushels per acre. On the other hand, while Bordeaux-Nicotine sprays decreased the percentage of hopper burn, these plots produced only one bushel more potatoes per acre. Bordeaux-lime (4-8-50) controlled hopper burn more effectively than either of the above sprays, but the yield was twelve bushels below that produced by Standard Bordeaux Mixture.

On the basis of these results, more extensive experiments were outlined for 1920. Comparisons were made using hand and power sprayers. These tests clearly indicated that there was a difference in relative control of hopper burn and in yield due to the method employed. These factors are considered in discussing the efficiency of the several sprays. Table I presents the data obtained from hand-sprayed plots treated with

Bordeaux-Lime and Bordeaux-Nicotine combinations. Table II presents similar data from machine-sprayed plots.

As in 1919, Bordeaux 4–4–50 produced a normal increase in yield. In hand sprayed plots 4–8–50 and 4–12–50 combinations produced yields often lower than their respective checks, even though hopper burn was decreased to four per cent. In machine-sprayed plots, each of these combinations produced less tubers than Bordeaux 4–4–50. Milk of Lime 8–50 controlled hopper burn fully as well as Bordeaux 4–8–50, but produced no increased yield. Kaolin added to Bordeaux 4–4–50 was not so effective as Bordeaux 4–8–50 in hopper burn control, and decreased the weight of tubers to about the same extent as the latter.

Other tests were made with Bordeaux-Lime-Nicotine and Nicotine-Soap combinations. Bordeaux-Nicotine sprays were quite effective in controlling leaf hopper, and reduced hopper burn to three per cent in hand-sprayed plots. On the other hand the yields were only slightly above Bordeaux 4–4–50. Bordeaux 4–8–50-Nicotine was superior to the 4–4–50-Nicotine combinations. Lime-Nicotine wash averaged less than 4–4–50 Nicotine mixture in tuber production, and was not so effective in control of hopper burn. Plots sprayed with Nicotine soap solution produced almost as many tubers as plots sprayed with Bordeaux 4–4–50, but hopper burn was more in evidence.

In all the tests Bordeaux sprays with excess lime effectively controlled hopper burn, but, as shown by Ritzema Bos, the shading effect of these washes materially decreased the potato yield. In plots sprayed with Bordeaux-Nicotine, the hopper burn was reduced to a minimum, but in each case the yield was only slightly above standard Bordeaux. In view of the fact that there is an added cost of $5.40 per acre in Nicotine sprays, with a corresponding average gain of but six bushels more per acre than with standard Bordeaux, is it not logical to question the economy of attempting the control of hopper burn in regions where there is comparatively little sunshine during the growing season?

TABLE I.—HAND SPRAYED PLOTS

Materials	Kind of Potatoes	Amount of Tipburn		Yield per Acre		Average Increase per Acre
		Treated percent	Check percent	Treated bu	Check bu.	
Bordeaux Mixture 4-4-50	Early	12	25	142	136	6
	Late	28	60	126	122	4
Bordeaux Mixture 4-8-50	Early	10	25	144	148	−4
	Late	10	60	122	122	0
Bordeaux Mixture 4-12-50	Early	4	25	137	150	−13
Milk of Lime 8-50	Late	34	70	90	89	1
Bordeaux Mixture 4-4-50 and Nicotine 1-800	Early	10	25	156	150	6
	Late	7	60	108	89	19
Bordeaux Mixture 4-8-50 and Nicotine 1-800	Late	3	60	134	122	12
Milk of Lime 8-50 and Nicotine 1-800	Late	24	60	124	122	2
Nicotine and Soap	Early	13	25	148	143	5
	Late	50	60	126	122	4

TABLE II.—MACHINE SPRAYED PLOTS

Materials	Kind of Potatoes	Amount of Tipburn		Yield per Acre		Average Increase per Acre bu.
		Treated percent	Check percent	Treated bu.	Check bu.	
Bordeaux Mixture 4-4-50.....	Late	40	70	176	154	22
	Late	50	70	176	145	31
Bordeaux Mixture 4-8-50	Late	28	70	176	165	11
	Late	28	70	175	145	30
Bordeaux Mixture 4-12-50	Late	25	70	165	145	20
Bordeaux Mixture 4-4-50 and Kaolin 60-100.....	Late	28	70	165	154	11
Bordeaux Mixture 4-4-50 and	Late	38	70	176	154	22
Nicotine 1-800	Late	28	60	203	152	51
Cage						

PRESIDENT WILMON NEWELL: The last paper of this series is by Mr. F. A. Fenton, and is entitled "Further Experiments with *Empoasca mali* Concerning its Relation to Potato Tipburn."

PROGRESS REPORT ON THE SEASON'S WORK ON THE PRODUCTION OF POTATO TIPBURN

By F. A. FENTON, *Iowa State College, Ames, Iowa*

During the past season experiments were continued in regard to the production of potato tipburn by the leafhopper, *Empoasca mali* Le Baron, and very interesting and significant data were obtained. These tests were conducted to determine the effect of artificial mutilation on the potato leaf, the result of colonizing leafhoppers on the plant foliage under different environmental conditions, the comparative effect of different stages of the insect on the leaves, the injury other insects might produce, and the effect of Bordeaux mixture on the leaf-hoppers.

EFFECT OF ARTIFICIAL MUTILATION ON POTATO LEAVES

In the first experiment the leaf veins or leaf petioles were mutilated with various instruments. These tests consisted in puncturing the mid-vein with "*minuten Nadeln*," with finely drawn glass thread, with blood dropper, and with the ovipositor of a hymenopterous insect. The mid-vein was also severed in different places with a scalpel. Individual leaves were mutilated once, twice and three times with the above instruments, which were not sterilized. When the leaves were punctured, little or no injury resulted, but when the mid-vein was severed, the leaf showed a distinct type of injury. This was first observed after a period of nineteen days when a triangular area at the tip of the leaf turned yellow and then brown, a condition identical with that of beginning tip-

burn. However, this dead area was comparatively small and confined to the extreme apical portion of the leaf. Furthermore, it did not increase in size in spite of the fact that the mid-vein was completely severed in as many as three distinct places.

Influence of Environmental Factors—Cage Experiments

July 29th a second series of tests was conducted in the greenhouse to determine the effect of the potato leafhopper on the plant under different environmental conditions of soil, humidity, and sunlight. These potted potato plants (Early Ohio variety) were all healthy and were caged with an equal number of leafhoppers, 50 adults and 50 nymphs being added to each cage. Daily observations were made and careful examinations conducted on August 6th and 10th, respectively, the experiment being closed on the latter date.

One series of plants growing in sand and another in loam were kept on a bench where they were in direct sunlight during the greater part of the day. Individual plants in each series were caged with leafhoppers. Burning began within twenty-four hours on those exposed to the insects and increased daily until they were badly injured at the close of the experiment. All check plants remained perfectly normal throughout the test. Potato vines growing in loam burned just as badly as those in sand, the type of soil having little or no influence on the final results.

In the second phase of the experiment one series of plants growing in loam were placed in pans of water, thus insuring a constant saturation of the soil with moisture; in the second series they were only watered occasionally and enough to keep them from wilting too much; while in the third they were kept in normally moist soil. All were placed where they were exposed to a maximum amount of sunlight. Plants were selected from each series and caged with leafhoppers. Burning developed within twenty-four hours and increased daily on all those exposed to the insects, all these vines being badly injured at the time the experiment was closed. Excess of soil moisture did not retard the burning nor did lack of it increase the injury, there being no difference in the amount of tipburn on the leaves under these different soil moisture conditions. Check plants were perfectly healthy when the experiment was closed.

To test the influence of high humidity on the production of tipburn, one series of plants were kept under glass globes over the top of which panes of glass were placed to prevent evaporation and thus keep the air surrounding the foliage in a water-saturated condition. Another series were kept as a check and all were placed in sunlight. Individual plants from each were enclosed with leafhoppers. As in the case of the

other tests tipburn began within twenty-four hours after the insects had been colonized on the vines and increased in severity each day. At the time the experiment was closed it was noted that the burning on the vines kept under bell jar conditions was not as severe as in the other cases and was somewhat obscured by physiological injury due to abnormal conditions. The slight decrease of injury was due to the fact that many of the leafhoppers were drowned in the drops of water collecting on the sides of the glass globe and that others were killed by disease induced by the abnormally high humidity. However, enough survived to produce typical injury. Check plants showed no signs of tipburn. This test indicated that retarded leaf transpiration or air saturated with moisture will not check tipburn provided leafhoppers are present.

The last series of experiments were made to show the influence of sunlight on the production of tipburn, to test whether its absence would prevent or change the type of injury induced by the leafhopper or whether its presence would increase burning on plants as compared with those kept in the shade. One series were kept on a bench in the greenhouse under a glass painted a dark green, the pots being in this artificial shade at all times of the day. Another series were kept in direct sunlight. Individual plants in each series were enclosed with the leafhoppers. Tipburn began on all of these within twenty-four hours and increased daily. At the time the experiment was closed all vines exposed to leafhopper attack were dead or nearly so, while the others were perfectly normal. Tipburn developed just as readily and as severely on those kept in the shade as on those in sunlight, provided they were exposed to leafhopper attack, showing that sunlight is clearly not a direct factor in producing or influencing tipburn.

In December additional evidence was obtained showing that the leafhopper is the principal cause of tipburn and that environmental factors have little influence except as they affect the insect. At this time typical injury on potted potato plants in the greenhouse was produced by colonizing nymphs on the leaves. During this experiment the days were almost uniformly cloudy, there being very little sunshine. It was noticed in this experiment that the leaves did not brown as rapidly as they did in the field or during cage tests in the summer, but otherwise the injury was identical.

Influence of Environmental Factors—Field Observations

Frequent observations were made in the experimental field to determine the progress of tipburn on the vines and daily counts[1] were made

[1]For a more detailed account see Albert Hartzell, "Further Notes on the Life History of the Potato Leafhopper" in Journal of Economic Entomology, Vol. XIV, 1921.

to ascertain the number of nymphs and adults present in the field. These results were plotted as shown in Figure 2. It is seen that there

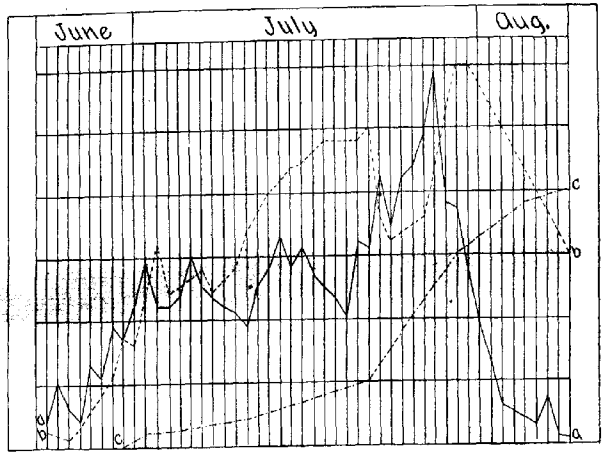


Fig. 2. Chart showing relation of leafhopper population to per cent. of tipburn. *a*, number of nymphs; *b*, number of adults; *c*, per cent. of tipburn.

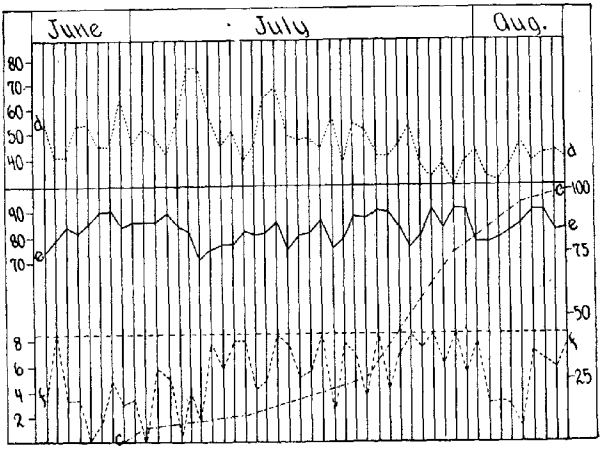


Fig. 3. Chart showing relation of climatic factors to per cent. of tipburn. *c*, per cent of tipburn; *d*, degrees minimum humidity; *e*, degrees maximum temperature; *f*, number hours sunshine.

was a distinct correlation between the leafhopper population and percentage of tipburn, the latter increasing with the increase in numbers of the leafhoppers. The abrupt drop in both nymph and adult curves was due to the death of all the plants in the field.

In Figure 3 curves were plotted representing the minimum humidity, maximum temperature, and total number of hours of sunlight, together with a curve showing the progress of tipburn in the field. The humidity records were taken from a hygrometer and checked with a sling psychrometer, and the temperature data were taken from readings from a maximum thermometer. The sunshine records were taken from a sunshine recorder and the total number of minutes of sunlight plotted from 9 a. m. to 4 p. m. It is seen that there was little correlation between the development of tipburn in this field and the amount of sunlight, maximum temperature, and minimum humidity.

Is Tipburn Systemic?

It was repeatedly observed that tipburn could be produced on the leaves of a plant by the use of the leafhoppers and that the injury was always confined to the plant tissues on which the insects were feeding. In no case did the disease advance from one part of the plant to another without the agency of nymphs. The most striking of these experiments was one started September 17th. A healthy Early Ohio plant having four distinct branches was chosen. Twenty-four nymphs which had just hatched within the past twenty-four hours were placed on one branch having seven leaves besides a rapidly expanding bud. A wad of absorbent cotton was tied around the stem to prevent migration by the nymphs to other parts of the plant. Twenty-four hours later these leaves plainly showed first signs of injury. Only twenty-one nymphs were counted on this date, three having died or escaped. This number remained on the tip for the next four days with the leaves showing increased injury daily. On the fifth day but seventeen nymphs were counted, four having escaped. On this date half of the three oldest leaves were diseased, the two next oldest had the tip rolled in, while the others showed signs of injury in the paling of the chlorophyl about the tip and margins. On the eighth day but eleven nymphs were counted, the rest having escaped or died. On this date the two oldest leaves were dead, the apical half of the two next oldest were half burned, the two younger leaves showed marked symptoms, while the youngest leaf and the entire bud were of an unhealthy color and showed clearly a loss in succulence. On the ninth day the entire tip was badly burned. The nymphs were now in the fifth instar and many of them were noticed to be feeding on the petioles and stem. On the eleventh

day the entire tip showed increased injury, and was so badly burned by the twelfth day that the nymphs were removed, there being no food left. Six were still in the fifth instar, the remaining having matured. The plant was photographed a few days later. In addition to demonstrating the local nature of the disorder, the above experiment shows that in severe cases the leaf petiole, stem, and even opening leaves are affected, the nymphs feeding on these places when obliged to.

Comparative Effect of Different Stages of the Insect

A set of experiments was conducted to determine the comparative effect of the different stages of the leafhopper on the potato foliage. In one test first instar nymphs were placed on normal leaflets and kept there by means of a wad of absorbent cotton tied around the leaf petiole. Leaves were confined with one, two and three nymphs, respectively. Those confined with one nymph developed the first symptoms in from six to nine days, depending upon the age of the nymphs which were in either the third or fourth instar. Those having two hoppers developed the first symptoms in from four to five days, the insects in this case being in either the second or third instar. Leaves on which three nymphs were placed showed tipburn in from three to five days, the insects being in either the first, second or third instar. When more insects were confined to a leaf, the burning developed still earlier. These tests showed that *mali* is capable of producing burning in all its nymphal stages, but that when one is confined to a leaf the amount of "toxic substance" introduced is not sufficient to produce the disease and that normally one nymph does not reach an "effective" size until the third or fourth instar.

In another series one and two fourth instar nymphs, respectively, were confined on potato leaves to determine the effect of this stage in developing tipburn. Five fourth instar nymphs placed on individual leaflets produced burning in from one to seven days. In all but one case the insect was in the fifth instar when burning was first noticed. Five leaflets on each of which two fourth instar nymphs were placed developed burning in from one to four days, there being little difference in the date of appearance of burning, whether there were one or two insects on the leaf. These and other experiments showed that where *mali* is in either the fourth or fifth instar, the symptoms are often produced on a normal leaflet within twenty-four hours.

In cages where equal numbers of adults and nymphs were added, burning developed much earlier and to a much greater extent in those cages having nymphs than in those having adults. Furthermore, adults confined to individual leaflets failed to produce the disease to any

extent whatever. Adults confined in cages on potato plants failed to produce any sign of burning if no nymphs were produced or if these were immediately removed after hatching. This indicates that, comparatively speaking, the adults are not nearly as effective in producing the disease as the nymphs are; that they will produce tipburn when introduced in great numbers on potato plants has been shown in field experiments.

Effect on Potato Leaves Produced by Other Insects

To test the injurious effects of other insects on potato leaves, one series of plants were caged with Buffalo treehopper nymphs (*Ceresa bubalus*), tarnished plant bug adults (*Lygus pratensis*), aphids (species unknown), and flea beetles (*Epitrix cucumeris*). Each of these insects produced a typical form of injury that in no way resembled the tipburn caused by the leafhopper. Buffalo treehopper nymphs girdled the stems of the plants by causing the tissue at the points of puncture to collapse and the entire tip to bend over and wilt. Tarnished plant bugs collected at the tips of the plants and caused a wilting and death of this part. Aphids at first produced no injury, but when the colony increased in numbers the plant first yellowed and then died. Flea beetles at first ate the typical round holes in the leaves and then when more were added cleaned off the entire leaf epidermis, killing the plant.

Why Does Bordeaux Mixture Prevent Tipburn?

It has been known for some time that Bordeaux mixture sprayed on potato plants reduced the amount of tipburn. When it was found that the leafhopper was responsible for the trouble attention was naturally attracted to the effect of this spray on these insects. Fluke[1] carried on some preliminary experiments which indicated that it had a repellent nature, and Parrott[2] substantiated these conclusions. It was observed, that under certain conditions Bordeaux mixture prevented tipburn to a large extent in our experimental plots, and as a result a series of cage experiments was started to discover the exact effect of this spray on the various stages of the leafhopper. The following results are preliminary but interesting.

August 30th a number of healthy Rural New Yorker variety potato plants growing in large two gallon crocks were sprayed with lime water and different strengths of Bordeaux mixture, each formula being used

[1]Fluke, C. L. Journal of Economic Entomology, Vol. 12, 1919, pages 256–257.
[2]Parrott, P. J. and Olmstead, R. D. Journal of Ecomonic Entomology, Vol. 13, 1920, pages 224–225, and New York Geneva Tech. Bull. 77, 1920.

alone and with nicotine at the rate of one part of this to 800 of Bordeaux mixture. Each plant was sprayed thoroughly with a small atomizer spray pump, both the upper and lower surfaces of the leaves being given a thorough coating. Plants were selected having two or more branches, one branch being protected from the spray at the time of application by being enclosed in a glass cylinder. After the spray material had thoroughly dried an equal number of fertile females were introduced into each cage. After ten days the females were removed and the hatching nymphs counted daily. It had been previously demonstrated that the very young nymph remained near the point of emergence from the leaf tissue for at least twenty-four hours after hatching. By counting the number of nymphs found on sprayed and unsprayed leaves it could be determined whether or not the egg had been laid in tissue coated with Bordeaux. The following table summarizes the results.

TABLE I.—COMPARISON OF HATCHING OF *E. mali* ON SPRAYED AND UNSPRAYED LEAVES

Cage No.	Lime formula	Bordeaux formula	No. female hoppers introduced	No. removed	No. nymphs hatched on unsprayed leaves	No. hatched on sprayed leaves	Total
a	4–50		5	4	60	0	60
b	4–50[1]		5	4	50	1	51
c		4–4–50	5	2	31	4	35
d		4–4–50[1]	5	2	16	2	18
e		5–5–50	5	2	23	2	25
f		5–5–50[1]	5	1	12	0	12
g		4–6–50	5	3	25	2	27
h		4–6–50[1]	5	2	3	0	3
Total					220	11	231

[1]Nicotiné added.

From the above preliminary test it was found that out of a total of 231 fertile eggs laid by the females but 11 were deposited in sprayed leaves. It was also noticed that in every case of a nymph hatching on a sprayed leaf, the latter was always imperfectly covered by the insecticide. While there are not enough data to indicate the comparative effect of different Bordeaux formulae on the adults, it is evident that this mixture or even lime water will repel the adults under certain conditions. Thus oviposition is prevented, provided the leaves are thoroughly covered by the spray, and there are unsprayed plants on which they can oviposit.

CONCLUSIONS

1. Tipburn or hopperburn of the potato is produced through the agency of *Empoasca mali*.

2. All nymphal stages of the leafhopper are capable of producing symptoms of the disease.

3. The older the nymphs the greater the amount of injury done, nymphs in the first and second instars being incapable of producing any effect on the leaf unless in numbers.

4. The greater the number of nymphs on a leaf the sooner the injury develops and the more rapidly the leaf or plant is killed.

5. The adult hopper is not nearly so effective as any of the nymphal stages but will produce the disease when concentrated in large numbers on a given plant.

6. The disease is produced to the same extent and just as soon under such diverse environmental conditions as type of soil, amount of moisture in the soil, presence or absence of sunlight, or reduced leaf transpiration.

7. Tipburn as a disease is localized, being confined to that part of the plant exposed to the attack of the leafhoppers, whether this be a leaflet or entire branch.

8. Other insects known to feed on potato such as Buffalo treehopper nymphs, tarnished plant bugs, potato aphis, and flea beetles, produce a type of injury characteristic of the individual species concerned but in no way resembling tipburn.

9. Bordeaux mixture prevents tipburn by repelling the ovipositing female leafhoppers.

PRESIDENT WILMON NEWELL: This subject is now open for discussion.

MR. R. L. WEBSTER: I would like to ask if any allowance was made for unavailable soil moisture; that is, sand as compared with loam?

MR. F. A. FENTON: We kept certain potted plants in a pan of water all the time, and we also kept them where the sand or loam was dry. There is a difference in the plant growth but not in percentage of tipburn.

MR. R. L. WEBSTER: There would be considerable difference in loam.

MR. F. A. FENTON: We found that we got tipburn just as quickly on plants in good rich soil as in sand. I noticed in traveling about the state that the type of soil seemed to make little difference. For instance, one field had but one spot that was badly tipburned and that was in a low part where there had been much water. Tipburn is always correlated with the number of leafhoppers. We found out, too, that the disease, you might call it such, is not systemic, that is, it does not travel from one part of the plant to another without the agency of the leafhopper.

MR. R. L. WEBSTER: I made some chemical tests recently on the effect of red spiders on the foliage of roses. There seems to be an accumulation of mucilages and pentosans; substances that take up water. That may be a factor in this situation.

MR. J. E. DUDLEY, JR.: An experiment at Madison, Wisconsin, this year might be of interest in connection with the previous papers. Individual plants of five varieties of potatoes were caged, two cages to each variety. In one cage over each variety there were about twenty adult leafhoppers placed the 12th of July. The other cages remained free of leafhoppers the whole season. In every case hopper-burn occurred in the cages in which leafhoppers were placed and in no case did it occur in cages which were kept free from them. In the cages in which it occurred it was not nearly as serious per variety as in the rest of the field, which would look as though the partially decreased transpiration in the cages retarded the spread of hopper-burn.

Potato flea beetles and potato aphids were found in all the cages. It was impossible to keep them out. As no hopper-burn occurred in the check cages, it would look as though we could eliminate these two insects as causal agents.

My experiments differ slightly in one respect from Mr. Fenton's; that is the rate of spread of hopper-burn. Observations would appear to indicate that hopper-burn will spread over a whole plant once the plant has been affected. I have seen that in several cases where one or two hoppers were placed on a plant for a week, say, and then taken off and the plant continued to droop until it was entirely dead.

MR. F. A. FENTON: We tried that experiment time and time again and we absolutely did not get any tip-burn. We caged a plant with adult leafhoppers and we knew that this plant was loaded with eggs. The hatching young were transferred from the leaves every twenty-four hours and no tip-burn was noticed. We had counts as high as several hundred young from one plant and yet when we removed these every day we did not get any tipburn.

MR. T. J. HEADLEE: I would like to know from Mr. Eyer whether there was any late blight connected with the experiments that would in any way influence the yield.

I would like to know from the last speaker whether tip-burn in his opinion is ever caused by any other agency than the hopper. I would like to know from Mr. Fenton what he considers the diagnostic characters of hopper-burn.

MR. J. R. EYER: In answer to Dr. Headlee's question regarding the matter of late blight, according to our plant pathologist who is located

at the experiment station, this disease was not a factor in any of our experiments for either 1919 or 1920, because we had no late blight in these potato plots.

MR. F. A. FENTON: In regard to the diagnostic characters, our results were identical with those of Dr. Ball,—that is, that the injury invariably begins at the tip or margin of the leaf and follows the veins. The vein will collapse first and then the tissues between will die. In other forms of tip-burn, the tissue between the veins will die and the veins themselves will remain green. If you put a large number of leafhoppers on the plant the leaves will wilt before they turn brown.

That reminds me that recently in the Potato Magazine, a gentleman from Vermont said that he produced tip-burn by concentration of sunlight on the plant through mirrors. It strikes me that this is abnormal. You would not find that in field conditions. On the other hand, you would find leafhoppers in the field.

MR. E. D. BALL: Further answering Mr. Headlee, there are four things that we find on the potatoes very commonly, and when you mention the diagnostic character of tip-burn you only need then to differentiate it from the other three. Under certain conditions, especially in greenhouses, you will often get a burning—a sunburn of potatoes —a case where the leaves have been subjected to too high termperature and too small moisture content in the soil and they actually die. In those cases you almost invariably find that the leaf is light in color. There is no relation to the veins and there may be no relation to the margin. You may have the burning right across the leaf, in the center, or any place like that. That, of course, is a rare thing. Besides that you have the two blights. But tip-burn is brown in color, always occurs on the margin of the leaf and runs in on the veins. The blights are almost invariably membrane troubles and not vein troubles, and cross right across veins angularly or in any way; it may occur inside of the leaf and not have any reference to the margin. Tip-burn is a margin and a vein condition and it occurs on the margin and runs in a V on the veins.

MR. Z. P. METCALF: I think we have here a complication of physiological processes which are really very poorly understood. It must be remembered that this same potato leaf-hopper is in the South the principal insect enemy of the soy-bean and causes on the leaves of the soy-bean a peculiar leaf spot on which a plant pathologist that I know worked for about five or six years and never arrived anywhere. He separated a distincitve organism from this spot, and yet he never could get that organism transferred from one leaf to another, unless the leaf-hopper was there.

Here we have the same insect, as far as anybody knows, producing an entirely different effect on another plant. And in this connection I want to say that we are studying the physiology of leaf spots on various plants caused by leaf-hoppers and plant-hoppers, and we find a great many of the spots that have been described in pathological literature are intimately bound up with these peculiar kinds of insects, but we know very little about the real physiology behind these things as yet.

MR. T. J. HEADLEE: One year ago this summer I asked Professor Ball about the diagnostic characters of this kind of injury. He gave them to me very much as they were stated to-day. I used the information to examine the conditions in our state. We raise about 15,000,000 bushels of potatoes, and I found some leaf-hopper injury, but I did not fine leaf-hopper injury or leaf-hopper burn as the principal source of what the plant pathologists usually call tip-burn.

MR. J. G. SANDERS: I had the privilege, last summer, of observing in Holland some very extensive experiments along this very line. Potatoes of similar varieties were similarly caged in cages of similar sizes made up of glass, wire and cloth. Invariably those potatoes with hoppers had tip-burn.

MR. P. J. PARROTT: It may be of interest to Dr. Headlee to hear of an experience with tip-burn in New York. In 1908 the leafhopper was very abundant on potatoes, and much browning of the foliage was noted in plantings where the insects were numerous. Injuries to the foliage were diagnosed by a phytopathologist as typical tip-burn, which identification by the way, mislead us as to the destructive capacities of the insects. In planning for field experiments with the leafhopper in 1919 we secured the assistance of a phytopathologist, who noted the occurrence of various diseases in the different plats. As some of you know, the unsprayed rows or checks were practically destroyed. The browning of the foliage was almost entirely due to the work of the leafhopper and Mr. Stewart, our phytopathologist, has gone on record as saying that the diseased condition of the check plants was not distinguishable from what he has heretofore designated as tip-burn.

MR. H. A. GOSSARD: I want to make one or two observations as to the cost of preventing tip-burn. It would appear to me that the cost of preventing tip-burn might exceed the value that you get in increased yield, yet because of the fact that leafhoppers are also concerned in transmitting fungus and bacterial disease, I would regard the appearance of tip-burn in a potato-patch as a good hint to get busy, regardless of the fact that it might cost more to prevent tip-burn than to suffer from it, because I might be preventing something much more costly than tip-burn.

PRESIDENT WILMON NEWELL: The next paper on the program is entitled "Chinch-bug Resistance Shown by Certain Varieties of Corn," by W. P. Flint.

CHINCH-BUG RESISTANCE SHOWN BY CERTAIN VARIETIES OF CORN

By W. P. FLINT, *Urbana, Ill.*

In localities where chinch-bugs have been abundant for a number of years, one will frequently hear statements from farmers that certain varieties of corn are not greatly damaged by them. Investigations of these statements have shown in most cases that some other factor than varietal resistance has been responsible for lessening the chinch-bug injury.

In the summer of 1917, Mr. J. J. Doerschuk, then county agent in Randolph county, Illinois, called the writer's attention to the fact that a variety of corn known locally as White Democrat seemed to be showing marked resistance to chinch-bug attack.

In the spring of 1918, under the supervision of Mr. Doerschuk, seven varieties of corn were planted in four-row strips in a field in a locality where chinch-bugs were extremely abundant. These varieties included White Democrat, Iowa Silver Mine, Boone County White, Sutton's Favorite, St. Charles County White, Yellow Ninety Day, and Reid's Yellow Dent. There were but few chinch-bugs in this field up to the time of their summer flight, which occurred when the corn was about three feet high. A general heavy infestation of the field resulted. The second brood of bugs was very abundant in this field. Early in October the stalks and ears from ten hills of corn of the White Democrat, Iowa Silver Mine, and Reid's Yellow Dent were carefully weighed, the weights being 53, 17, and 11 pounds, respectively. None of the other varieties were as good as the Reid's Yellow Dent.

In 1919, White Democrat and a local strain of Reid's Yellow Dent were sown in alternate strips of two rows each in fields of fifteen to twenty acres in two widely separated localities where chinch-bugs were abundant. By the first of September one could easily distinguish the varieties from a distance, at least 80 per cent. of the White Democrat stalks were standing, while the stalks of Reid's Yellow Dent had nearly all fallen from the effect of the chinch-bug injury. The corn was harvested in October, in one of the fields Reid's Yellow Dent yielding 21½ bushels and White Democrat 30½ bushels per acre; in the other 15½ and 19¼ bushels per acre, respectively. The difference in the corn was very marked, the White Democrat being well matured and in good condi-

tion for cribbing. The Reid's Yellow Dent, on the other hand, was soft and spongy, and practically worthless.

In 1920 further experiments were conducted. Varieties were selected because of their known resistance to drouth and supposed adaptability to the type of soil found in the counties most heavily infested with chinch-bugs. The varieties used were White Democrat, Black Hawk, St. Charles County White, Arlington Prolific, Pride of Saline, U. S. Selection 77, Freed W. Dent, Colby Bloody Butcher, Lancaster Surecrop, U. S. Selection 133, Minnesota No. 13, Northwestern Dent, and Gehu. These varieties of corn were secured through the Crops Department of the United States Department of Agriculture, from entomologists in adjoining states, and from the Crops Department of the University of Illinois.

During the summer flight of the chinch-bugs, all varieties in the field were heavily infested. There was a more noticeable difference in the effect on the several varieties in this season's test than in any of those previously conducted. By September 6th, every hill of two varieties had been killed, all the others showing more or less injury from the bugs. The White Democrat, Black Hawk, and St. Charles County White were in a fair condition, considering the severity of the infestation. The corn was harvested October 2d and carefully weighed by Mr. S. C. Chandler of this office. The results show a variation in yield from nothing in the case of Gehu and Northwestern Dent, to 16.5 bushels per acre in the case of the White Democrat. Two fields of about twenty acres each in another locality where chinch-bugs were very abundant were planted half to Reid's Yellow Dent and half to White Democrat. The corn in these fields was harvested late in October, the White Democrat making from twenty to twenty-five bushels per acre, while the Reid's Yellow Dent was so badly damaged that practically none of the ears had matured. No yields were taken.

Field observations in the counties heavily infested with chinch-bugs have shown the White Democrat corn markedly resistant when grown on fertile soil. No fewer bugs have been found on this corn than on other varieties. The higher yield of this and several other varieties seems to be entirely due to their power to resist chinch-bug attack. All are corns of the flint type. The White Democrat, which is a strain of Champion White Pearl, has a thick, leafy stalk, and a blunt, rather short, ear. The kernel is broad, smooth, and hard, with a high protein content. Black Hawk, the next highest yielding variety in the 1920 tests, is a similar red corn.

More extensive tests including a number of other varieties will be conducted during next season. It is not thought possible to develop

any strain of corn sufficiently resistant to chinch-bug attack to withstand the onslaught of the nearly full-grown first brood bugs when they leave the wheat fields at harvest time. The results thus far obtained seem to prove that certain strains of corn show greater resistance to chinch-bugs than others, and that where these strains are grown on fertile soil in areas infested by chinch-bugs and protected from attack by the first brood of bugs, moderate yields may be expected.

PRESIDENT WILMON NEWELL: How did these varieties compare in maturity at the time of the chinch-bug attack?

MR. W. P. FLINT: There was some difference in the different varieties, but it was not very great. We tried to select those with similar maturity. They were all varieties that mature in about 100 to 110 days.

PRESIDENT WILMON NEWELL: The next paper is by Mr. E. P. Felt, on the "European Corn Borer in New York State."

EUROPEAN CORN BORER IN NEW YORK STATE

By E. P. FELT, *Albany, N. Y.*

The known infested area in New York State as indicated by published Federal quarantines, comprises 67 towns and cities located in 11 counties, a total area of over 2200 square miles.

The eastern infested area includes 1326.76 square miles according to data kindly supplied by Mr. Worthley, is irregularly rectangular in shape and centers approximately upon Schenectady. The federal scouting of the present year has added 12 towns to this area, the extension rarely exceeding five miles in any one direction and since an area of about two towns has been scouted outside the infested territory, the limits of this infestation are fairly well defined and the spread must be characterized as moderate, certainly not alarming.

The western area covers 936 square miles, the extensions this year north of Buffalo and west of Dunkirk being approximately 25 miles in each direction and including 14 additional towns. It was not possible to scout this area as thoroughly as was desirable in 1919 and consequently a portion of this new area may have been due to infestations not disclosed the preceding season.

The following data are based upon field work conducted by Mr. D. B. Young and Hall B. Carpenter under the writer's direction, the eastern area being given the closest attention.

Planting of sweet corn in the eastern area began as early as May 14th and some of the very early fields were up the 23d, some fields of field

corn being 10 to 13 inches high July 7th and some early sweet corn mostly tasseled out by the 26th.

Corn develops so early and the moths fly so late that oviposition upon the ear with little leaf or tassel injury may occur and this seems to have been the case in at least one field.

The first pupa was reported by federal men June 15th, the first moths were taken in the field July 1st and the first egg masses July 8th while the last moth was found in the field July 29th. There was no evidence of the development of a second brood or the deposition of eggs and the development to full grown caterpillars of corn borers upon plants other than corn, although larvae were active as late as November 12 when freezing temperatures prevailed at night and snow squalls occurred in the day.

Stubble Infestation

An area of a field having a 10.52 per cent stalk infestation was carefully examined and the 551 stalks contained 68 borers or a stalk infestation for this area of 12.34 per cent. The stubble was also examined, each butt being cut open and only four borers were found or an infestation of but .72 per cent.

Another field with an average stalk infestation of 34.85 per cent. was also examined and in this case the stubble was cut unusually high, approximately 15 inches and out of 310, 42 or 13.54 per cent. were infested.

In both fields, the number of borers at or below the surface of the ground was very small, probably less than 0.10 per cent.

The observations in the eastern area were checked by examinations in the western section and so far as could be determined, development was practically identical though in the western area there appeared to be a somewhat heavier infestation about Silver Creek and in certain fields a relatively greater invasion of nearby plants by partly or nearly full grown borers.

The stalk infestation in the Schenectady area varied from nearly 35 per cent. on some river bottom fields near the presumable center of the infestation to a very sparse occurrence of the borers on the outer margins of the infested territory.

Corn fields showing a stalk infestation of 10 per cent. or more were limited to an irregular, narrowly triangular area centering approximately upon the river flats of Scotia and covering some 15 square miles, the greatest extension from the presumable center being five miles up the Mohawk river and about three miles back from the river.

The area comprising fields which may show a stalk infestation of from 5 to 10 per cent. covers approximately 25 square miles lying out-

side of the more heavily infested section mentioned above, and extends up the river for about eight miles and back from the river some five miles.

The above statements regarding infestation should not be construed as implying that all fields in either area are necessarily infested to the degree indicated because as will be pointed out below, much appears to depend upon the time of planting, the nearness of infested materials and the direction of the prevailing winds.

The influence of the time of planting in the infested area is strikingly shown by two fields of Howling Mob sweet corn, one planted May 20th and next an infested field of last year and the other planted July 7th and only 100 feet away across a road. The first had a stalk infestation of 10.52 per cent and in the second only one affected stalk was found. In another instance over three acres were planted with Early Dawn and Golden Bantam May 8th and 13th and had a stalk infestation of four per cent. while a nearby acre of Golden Bantam planted June 25th had but three stalks affected or less than one per cent.

The date of planting is only an approximate indication of the condition of growth at the time the moths fly. A rather striking instance of this was found in western New York in a large field which was planted on the same date, approximately one-half being in White Dent and the other half in Evergreen. The latter was nearer the presumable source of infestation and yet showed a hill infestation of but 7.5 per cent. as compared with the White Dent of 18.18 per cent. The owner stated that the Evergreen developed more slowly and the probabilities are that the White Dent was in a more attractive condition at the time the moths were flying and consequently they passed over the Evergreen in great measure and oviposited mostly in the White Dent. It is worthy of note, in this connection, that depressions in rolling fields, if conditions permit early and vigorous growth, are likely to show a heavier infestation.

The nearness of infested material has a decided influence upon infestation. The heaviest infested fields were near known sources of infestation and in a number of cases the infestation began and was decidedly more marked on the side of the field next an earlier infested area or source of infestation.

The direction of the prevailing winds likewise has an important influence. One of the most striking cases was that of two fields in the Mohawk river bottom, one with a stalk infestation of 19.94 per cent. and the other of only 5.46 per cent. The first was in direct line of the prevailing winds from an infested area of the preceding season and the other only about 200 feet north and therefore outside the presumably usual drift of the moths.

It is difficult to make general statements applicable to the infested area with its numerous variations in the amount of injury due to local causes. Generally speaking a 30 per cent. stalk infestation is necessary to produce marked, commercial injury though in some fields with a 10 per cent. stalk infestation as high as five per cent. of the ears of sweet corn were affected and judging from conditions in other single brooded areas, a 90 per cent. stalk infestation of field corn by no means implies the destruction of the entire crop, though it does involve serious damage. There has been in New York State no very serious losses due to the actual work of the European Corn Borer though the 30 per cent. to 40 per cent. stalk infestation in the more seriously infested areas suggests a probability of increased injury and possibly an approximation to the great damage caused in certain Canadian areas.

The developments of the past season in New York State indicate a continued though not excessive spread accompanied apparently by increasing injury which may reach serious proportions, unless the true character of the insect is recognized and agricultural practices modified so as to reduce to a practical minimum the probabilities of the insect wintering successfully. With these conditions in mind, the State is giving special attention to the promotion of better methods of handling the corn crop in order to anticipate possible serious damage and at the same time is cooperating with the Federal Government in enforcing quarantine regulations designed to control the spread of the pest, especially through commercial agencies.

MR. GLENN W. HERRICK: I noticed in Dr. Howard's last report that the moth had been found depositing its eggs on several different food plants other than corn.

MR. W. R. WALTON: Eggs have been found in considerable number on beet stems and celery during the latter part of the season, and on two or three other cultivated plants. These data will all be published soon.

MR. F. A. FENTON: I would like to ask if eggs laid on these food plants necessarily mean that the larvae will develop. This year we had a very bad outbreak of the army worm in Iowa. The Tachina fly reduced them to a minimum, and later when these flies came out in tremendous numbers, they had to lay their eggs on something, and practically every insect that was abundant was oviposited on. We found Colorado potato beetles covered with eggs, probably of this species, but they did not develop.

MR. W. R. WALTON: This is the first season that corn borer eggs have been found on these particular plants. They have been known

to be infested by the larvae for several seasons, and the insect has been reared to maturity from them.

MR. C. H. TURNER: In regard to the size of the plant, we had results at the Schenectady laboratory that bore out Dr. Felt's conclusions. We had one plot planted the eighth of May and another the last of June. The infestation was almost entirely in the older plot. The moths had crossed the young corn to reach the earlier plot, and they showed selection according to the height of the plant. Most of the eggs were laid on the taller corn, particularly on the large, broad-leaf varieties.

MR. E. P. FELT: I would like to ask if there are any data to show a tendency toward infestation of one variety or a group of varieties, rather than another.

MR. C. H. TURNER: Yes. The large, broad-leaf varieties showed evidence of infestation. This was particularly true the first of the season. Later, the smaller varieties, while they did not have as many eggs, in the early part of the season, acquired infestation probably from migration.

At the end of the season, the stalk infestation was slightly greater in the smaller varieties. The average for the small varieties was about 42 per cent.; in the larger ones, 38 per cent. These figures are approximately correct.

PRESIDENT WILMON NEWELL: The next paper is "The Corn Leaf Aphis (*Aphis maidis Fitch*) in Kansas," by J. W. McColloch.

THE CORN LEAF APHIS (*Aphis maidis* Fitch) IN KANSAS[1]

By J. W. MCCOLLOCH, *Associate Entomologist, Kansas Agricultural Experiment Station*

The data on which the present paper is based are the results of certain observations made while studying corn insects at this Station. The study was prompted by numerous complaints of injury reported during the past few years, and by an apparent minimizing of the damage done by this insect. The results indicate that in Kansas, *A. maidis* must be considered not only as a serious pest of corn, but also as an enemy of the various sorghum crops. It is present every year on these crops, causing more or less injury, but as in the case of many of the aphids, it is difficult

[1]Contribution No. 62 from the Entomological Laboratory, Kansas State Agricultural College. This paper embodies some of the results obtained in the prosecution of project 9 of the Agricultural Experiment Station.

to estimate the actual loss since much of the injury is obscure and often attributed to other factors. During the past five years, several distinct lines of investigational work have been under way. The present paper, however, is limited to a discussion of the more important types of injury and to certain experiments indicating possible means for the reduction of the injury.

Injury to Corn

In the case of corn, all parts of the plant above ground are subject to injury, although the greatest damage occurs to the tassel. The aphids usually appear on corn during the last of June or the first of July, and are to be found deep in the curl feeding on the tenderer parts of the leaves. As the tassel develops in the curl, these insects forsake the leaves, concentrating on the tassel and especially on the central branch, resulting in several types of injury. The entire tassel may become so heavily infested that it fails to function (Plate 2, fig. 1). This type of injury was rather common in 1919, amounting to 10 per cent. of the plants in many of the fields about Manhattan. A more common form of damage, however, is caused by the concentration of the aphids in the central branch and a few adjacent branches of the tassel where they prevent the shedding of pollen by sapping the juices and gumming the spikelets with honey dew (Plate 2, fig. 3a). In 1920, in the vicinity of Manhattan, approximately 50 percent. of the corn plants exhibited this type of injury to such an extent that no pollen was shed. This meant a loss of from 15 to 20 percent. of the pollen, and since the central branch is the first to shed pollen, this is an important item. The corn crop of Kansas is often dependent on the early pollination of the silks, since the hot winds and dry weather of midsummer may be fatal to both tassels and silks. In addition, the emergence of the tassel may be delayed or it may not fully emerge from the boot, in either case resulting in a loss of pollen. Plate 2, figure 2, shows a plant whose tassel has not fully emerged from the boot, while plate 3, figure 4 shows a normal tassel. In the case where the tassel does not fully emerge, much of the pollen is caught in the axils of the leaves where it offers an ideal medium for the development of molds and rots, frequently resulting in the entire loss of the top. These growths often extend down the stalks (Plate 3, fig. 5), producing a weakened condition which is detrimental to the developing ear. As a rule the leaves show little injury, but in cases of severe infestation they may become yellow and occasionally die. During the past two years very little direct injury to the ears has been noted. In a few cases aphids were found in large numbers on ears when they were feeding on the silks and the soft grains. As a result, maturity was hastened and the ears were small and poorly filled.

Indirectly, this aphis may also be considered injurious to corn, since the honey dew secreted by it forms one of the main sources of food for the moths of the corn earworm and other insects of the corn field. It is also generally associated with physodermal disease of corn and there is a strong possibility that it may be concerned in the transmission of this disease.

Injury to Sorghums

The injury to sorghums, while general throughout the state, appears to increase westward. Mr. J. H. Parker of the local Agronomy Department, after a trip through western Kansas in September, 1919, examining sorghum fields, reported that the corn leaf-aphis had ruined the crop in that section. The heads were very heavily infested and the grain so badly shriveled that much of it was worthless.

All kinds of sorghums are attacked by the aphids, although there is apparently a difference in the injury of the different varieties. The percentage of plants showing appreciable injury in a test of seventeen varieties conducted in 1919 by Mr. W. P. Hayes, varied from 3.1 percent. in the case of Sudan grass to 96.5 percent. for feterita (Table I).

Table I.—Percentage of Plants Showing Appreciable Injury in Variety Test of Sorghums, 1919

Variety	Percent. plants injured	Variety	Percent. plants injured
Black hull kafir	77.8	Feterita	96.5
Dwarf black hull kafir	65.0	Freed's Sorghum	78.8
Dawn kafir	46.2	Red Amber	85.8
Shrock kafir	91.6	Kansas Orange	25.8
Sunrise kafir	67.1	Sumac Sorghum	46.4
Pink kafir	74.9	Dwarf Sumac Sorg.	21.3
Red kafir	84.5	Hagena	67.1
Dorso	96.3	Sudan	3.1
Yellow milo	77.6		

As in the case of corn, several distinct types of injury are noted. The infestation usually begins in the developing curl, and the aphids feed on the more succulent part of the leaves. As the heads develop they attack these, sapping the juices from the developing grain. The heads often become covered with the honey dew and later with molds or fungi, which give them an unsightly appearance. The reddish discoloration on the sorghums, due to bacterial infections, is usually associated with *A. maidis*, and often becomes serious enough to cause the rotting of the whole stalk. In 1920 the stalks of from 7 to 10 percent. of the plants in a kafir field were heavily infested with *A. maidis* and bacterial blight. The infestation resulted in shrinking the head, causing a loss of about 33 percent. in weight and 50 percent. in volume. (Plate 3, fig. 6).

Control

A. maidis, like many of the aphids, presents numerous difficulties in the way of control. The great rapidity with which it increases, its

manner of feeding, at least in part, in protected situations, together with the fact that the seasonal history is only indefinitely known, indicate some of the difficulties to be encountered. Experimental tests with nicotine sulphate sprays gave excellent results in killing the aphids, but the problem of spraying corn and sorghum fields is out of the question.

Certain observations on the date of planting corn and on variety tests of corn indicate that the injury can be materially reduced, and that further studies along this line may open the way for definite methods of control.

Time of Planting Corn

Observations were made in 1919 and 1920 on the number of plants injured in the Time of Planting Corn experiments conducted by the Entomology Department, and also on a date of planting test at the Agronomy farm in 1919. The counts of 1919 include only those plants showing severe injury such as is seen in Plate 2, figure 1, while the 1920 counts took into consideration all plants showing appreciable injury. The results, which are presented in Tables II to IV, indicate that with the possible exception of Hildreth, the injury increases with the delay in planting until about the middle of May.

Table II.—Percentage of Plants Showing Severe Injury, Entomology Plots, 1919

Variety of corn	Date of Planting				
	April 15	May 1	May 15	June 1	June 15
Boone Co. White	13.9	10.6	18.3	18.3	13.8
Pride of Saline	7.6	11.8	17.0	19.9	13.7
Commercial White	18.6	21.3	25.2	27.7	20.2
Kansas Sunflower	7.6	10.8	14.4	16.6	15.6
Hildreth	17.8	12.6	12.6	16.0	12.5

Table III.—Percentage of Pride of Saline Plants Showing Severe Injury, Agronomy Farm, 1919

Method of Planting	Date of Planting				
	April 16	April 21	May 3	May 10	May 20
Open furrow	4.8	8.6	10.0	15.7	10.0
Listed	8.9	9.5	18.0	16.9	10.1
Surface planted	5.6	5.0	10.7	9.8	4.7

Table IV.—Percentage of Plants Showing Appreciable Injury, Entomology Plots, 1920

Variety of corn	Date of Planting					
	April 24	May 1	May 8	May 15	May 22	May 29
Boone Co. White	58.9	58.1	67.8	63.7	64.5	67.1
Pride of Saline	58.1	45.0	49.2	58.3	66.6	56.9
Commercial White	59.6	65.7	58.1	67.7	65.3	41.4
Kansas Sunflower	48.2	46.7	55.1	56.5	59.1	55.1
Hildreth	50.0	47.7	46.5	50.0	57.3	44.0

Variety Tests of Corn

The observations on different varieties of corn were similar to those on the Date of Planting Tests in that only severe injury was counted in 1919, while all plants showing appreciable injury were noted in 1920.

Referring to Tables II and IV, it will be noticed that Commercial white shows a marked increase in injury over the other varieties in nearly all the date plots. Likewise, there is some indication that Hildreth is not as susceptible to injury. In order to determine whether Commercial White was as badly injured when grown in general fields, a comparison was made between a field of it and a field of Pride of Saline, both fields being planted about May 5. The field of Commercial White had 14.9 percent. of the plants severely injured, while Pride of Saline had only 6.8 percent. In addition to these experiments, counts were made of the injury in variety tests in the Entomology plots and at the Agronomy farm. The result of these studies are presented in Table V.

TABLE V.—PERCENTAGE OF PLANTS SHOWING SEVERE INJURY IN 1919 AND APPRECIABLE INJURY IN 1920[1]

Variety	Agronomy Farm First Series 1919	Agronomy Farm Second Series 1919	Entomology Plots 1919	Entomology Plots 1920
White Democrat			32.0	56.7
Commercial White	14.1	18.3	21.3	59.9
Midland Yellow Dent	17.4	13.3	23.4	46.2
Freed's x Pride of Saline	8.9	13.4		
Corn Planter	9.4	11.5	24.2	51.3
Pride of Saline	10.3	12.3	11.8	53.8
Roseland White	11.7	9.5		
20th Century	4.2	2.3		
Hildreth	9.7	8.0	12.6	56.4
Shawnee White	6.6	8.1	22.4	50.5
Boone County White	5.5	9.6	10.6	59.3
Reid's x Pride of Saline	4.1	13.2		
Reid's Yellow Dent	4.1	11.0	17.7	47.4
Iowa Silvermine	17.8	6.8	13.0	44.8
Kansas Sunflower	3.3	10.1	10.8	49.2
Colby Bloody Butcher	2.9	5.6	10.0	37.2
Sherrod x Pride of Saline	4.2	1.7		
Freed's W. D.	1.0	3.3	9.1	43.3
Corn Planter x Pride of Saline	2.6	6.3		
Funk Yellow Dent 330			7.5	29.7
Funk Yellow Dent..329			6.2	29.5
Sherrod W. D.	2.7	0.0	3.8	39.6
Funk Y. D. 335			2.8	37.0
Funk Bloody Butcher	0.0	0.0	3.7	34.5
Ninety Day	2.3	0.5		
Crille Bloody Butcher			5.0	18.5
Deyo N. W. Dent			2.3	20.1
Silver King	0.0	0.6	2.2	19.8
Minnesota No. 13	0.0	0.0	1.9	5.7
Deyo Bloody Butcher			0.6	11.6

[1]The varieties are ranked in this table with relation to their apparent susceptibility to injury.

In summarizing the data presented in Table V, it will be noted that the amount of injury increases with the lateness of the variety. Late maturing varieties, such as White Democrat, Commercial White, Midland Yellow Dent, and Corn Planter, suffered the greatest damage, while such early maturing varieties as Minnesota No. 13, 90 Day, Funk Yellow Dents, and the various strains of Bloody Butcher, had a comparatively low percentage of injury. There is also some indication that certain varieties are not infested as badly as others, although they have about the same growing period. This is strikingly exhibited by

Hildreth, which is one of the late varieties, but which shows a marked reduction in injury over Commercial White and White Democrat, two varieties requiring approximately the same growing period as Hildreth.

PRESIDENT WILMON NEWELL: The next paper is "A Contribution Toward the Control of *Peridroma saucia* as a Tomato Fruit Worm," by C. L. Metcalf.

A CONTRIBUTION TOWARD THE CONTROL OF PERIDROMA SAUCIA AS A TOMATO FRUIT WORM

By C. L. METCALF, *Columbus, Ohio*

(Paper withdrawn for publication elsewhere)

MR. GEORGE A. DEAN: I should like to ask Dr. Metcalf if he used either lemons or oranges in the bran mash.

MR. C. L. METCALF: Not in this particular test, though they were used in some of the other experiments apparently with no attractiveness for the larvae over the mash without them.

MR. GEORGE A. DEAN: I will say that in Kansas we have had three rather serious outbreaks of the cutworm. We had one in 1909 when we made a miserable failure in the use of poison bran mash without the fruit juice, either lemons or oranges, which had not been used previous to that time. In 1914, when we had the large outbreak of both cutworms and army worms, the poison bran mash with lemons and oranges was used and this gave practically one hundred per cent. control. Again in 1919, when we had the great outbreak on alfalfa over the entire state, we used the poison bran mash with lemons and oranges successfully. In all these outbreaks the cutworm took on the habits of an army worm, going over the whole field, and in every instance where we used the bran mash with the fruit juice, we brought the insect under control. But in 1909 we had a miserable failure without it.

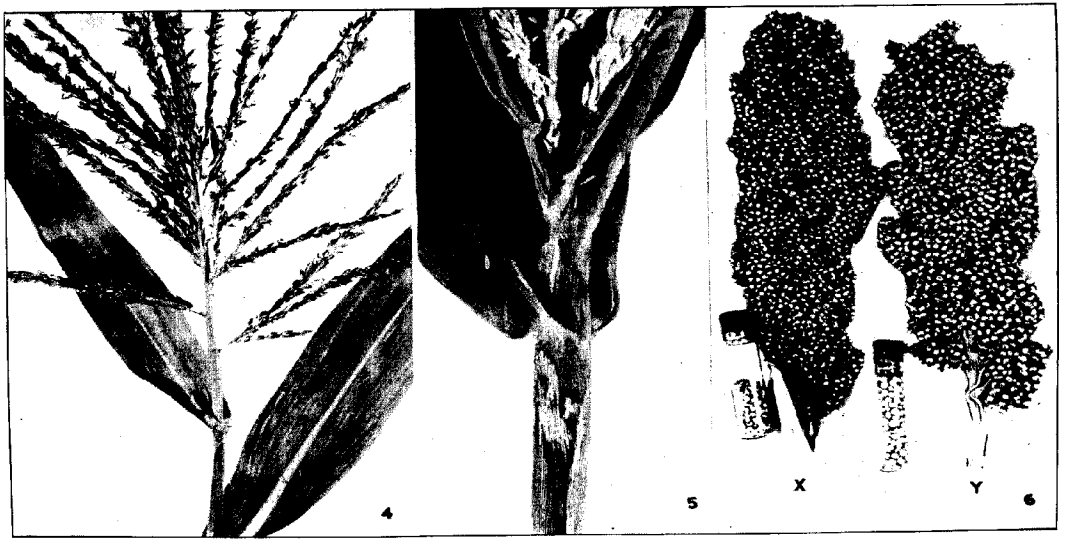
PRESIDENT WILMON NEWELL: The next paper is entitled "The Pea Moth in Wisconsin," by Charles L. Fluke, Jr.

THE PEA MOTH IN WISCONSIN

By CHAS. L. FLUKE, JR., *University of Wisconsin, Madison*

The pea moth is one of the most serious pests of peas in northeastern Wisconsin. This insect is as important to the pea growers in the penin-

1, Tassel heavily infested with aphids: 2, Infested tassel which has failed to emerge from the boot; 3, Central branches of tassels; A, badly infested, with the spikelets gummed together preventing the shedding of pollen; C, Not infested, the spikelets have opened normally.



4, Normal tassel; 5, Stalk showing decay at base of tassel following aphid injury; 6, Heads of Kafir (X) from a stalk badly infested with aphids and (Y) from an adjoining uninfested plant. Each vial contains 300 seeds from the respective heads.

sular district as the codling moth is to the apple growers of Wisconsin. As many as 2 to 50 per cent. of the pods are infested each year, but unlike the codling moth there is as yet no known efficient remedy to check it.

Until just recently the pea moth of this country was known as the European pea moth—*Laspeyresia nigricana* Stephens, but according to Heinrich[10] our species is distinct and is now known as *Laspeyresia novimundi*. Except where indicated the data, here presented, covering life history studies were gathered during the 1920 season.

Distribution

Mr. Heinrich suggests that "if *novimundi* is not a native species that has gone over to the pea from some wild legume, it has probably been introduced from the Orient." The first report of the destructiveness of a moth similar to if not the same as *novimundi* in this country came from Canada. Fletcher in 1895 reported it injurious in Ontario, Quebec, and the Maritime Provinces. In 1909 Chittenden,[7] reported the occurrence of the pea moth in Michigan.

The pea moth has been known to be destructive in Wisconsin for the past 15 years. One farmer in Brown County declared that he knew the insect as an enemy of peas some thirty years ago. From this evidence it is possible that it has been in the borders of the United States since about 1890.

Characteristic Injury

The larvae of the pea moth injure the peas by boring into the pods and feeding upon the growing and ripening peas within. The young larvae make very tiny holes when entering the pods and these entrances are not observable after the larvae are within. The young feed upon one or all of the peas in each pod. Frass soon accumulates and this is webbed together and forms a filthy mass around the peas. Upon opening the pods the larvae are nearly always found within these masses and feeding upon the seeds which are near. There is no indication from the outside that the pods are infested; they must be opened to detect the presence of the worms.

Larvae have been found in the majority of cases in partly grown pods; however, numerous very young larvae were noticed in nearly ripe pods, even though there were immature pods still on the vines.

Food Plants

If the pea moth in this country is a native species and indications at present are that it is, another food plant other than cultivated peas will probably be found. At present *novimundi* is known to attack only

field and garden varieties and is more particularly a pest of peas grown for the seed than those raised for canning, since the latter varieties are nearly always harvested before the moth begins its activities.

Seasonal History and Habits

The winter is spent in the larval stage. On leaving the pods in late summer or fall, the larvae make their way a very short distance into the soil, forming a cocoon of soil particles webbed together and lining the interior with silk. The cocoon is not nearly as strong as the one formed by the codling moth. If stones are in the soil or old straw lying on the surface, the larvae attach their cocoons firmly to these objects.

In the spring, beginning about June 15th, the first pupae are formed and in about three or four weeks the moths begin to emerge. During the 1920 season the first moths were collected in the field July 12th, the same date the first ones were noticed in 1919. This past season moths were noticed in the field up to July 28. At this time the weather changed, becoming so damp and chilly that very little insect life was active. Within a week warmer days prevailed but diligent collecting secured no adult moths. Of the collected moths kept in the insectary the last one died August 5th. An average of 18 eggs per female was secured from 36 females in cages in the insectary.

About three days after the first moths emerged egg deposition began. In the field the majority of the eggs were found on young pods; quite a few on the leaves; a few on the sepals of young pods; some on the stems; and also a few on the leaves and stems of grasses growing in the pea fields. From the records of 278 eggs which were deposited in an outdoor insectary, the length of incubation period was found to be from 7 to 9 days with an average of 8 days. Within two days from oviposition the red streaks appeared and 5 days later the black spots were formed. In practically every case the eggs hatched the day following the appearance of the black spots. The percentage of infertile eggs was almost none.

The first eggs hatched July 23, the maximum number July 27, and the last ones August 11.

Under insectary conditions the first larvae emerged from the pods August 6, and they continued to emerge until August 29.

The larval period varied from 10 to 27 days with an average of 18.2 days.

From a study of the life history of this insect it is seen that it is inactive for nearly ten months of the year; only two months time being necessary for development from larval stage to larval stage.

Remedies

As yet no practical method has been found that will control the pea moth in Wisconsin. Several sprays, mostly arsenical, have been tried; selections of early varieties, and the planting of these varieties at different times have also been tested but with no practical control results. There is a possibility of checking the pest by proper rotation of crops. The use of a good ovicide also remains for experimentation.

Table Number I

Total Females	Total eggs deposited in insectary	
	On Pea Leaves	On glass jars
36	296	354
Total	650	

Average Number per ♀ 18.

Table Number II

No. of eggs	Date laid	Days before appearance of		Date hatched	Length of incubation period
		red spots	black spots		
11	July 15	2	7	July 23	8
34	July 16	2	7	July 24	8
56	July 18	2	6	July 26	8
21	July 19	2	7	July 27	8
42	July 20	2	7	July 28	8
12	July 21	2	7	July 29	8
11	July 22	2	7	July 30	8
4	July 25	2	5	Aug. 1	7
27	July 26	2	6	Aug. 2	7
30	July 27	2	6	Aug. 4	8
25	July 28	1½	7	Aug. 5	8
4	July 29	2	8	Aug. 7	9
1	Aug. 2	3	8	Aug. 11	9
278	Averages	2	7		8

Table Number III, Emergence of Larvae From Pods

Date	Number Emerged	Date	Number Emerged
August 6	1	August 18	5
August 7	2	August 19	4
August 8	1	August 20	4
August 9	4	August 21	6
August 10	3	August 22	2
August 11	7	August 23	4
August 12	3	August 24	4
August 13	1	August 25	3
August 14	4	August 26	0
August 15	7	August 27	1
August 16	3	August 28	2
August 17	9	August 29	1

Total—81

' TABLE NUMBER IV

	Length of Larval Period in Days																	
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
No of larvae	2	3	3	5	5	4	4	8	7	8	7	8	6	3	4	2	1	1

Shortest period—10 days Total days 1474
Maximum period—27 days Total larvae 81
Average length of period 18.2 days.

REFERENCES

1. 1895—FLETCHER, J. Can. Exp. Farms Rept. for 1894, pp. 187–192. Reports injury to peas in Ontario, Quebec and Nova Scotia.

2. 1897—*Ibid* for 1896, pp. 228–9. In which he quotes a letter from a New Brunswick man as follows: "This pest has existed here at least forty years."

3. 1898—*Ibid* for 1897, pp. 194–5. Reports identification by C. H. Fernald, from a "greasy, unspread" adult specimen.

4. 1899—*Ibid* for 1898, pp. 191–2. The use of early varieties of peas as a control measure.

5. 1901—*Ibid* for 1900, p. 214. Suggests use of Paris Green.

6. 1902—CHITTENDEN, F. H. U. S. Bur. Ent. Bul. n. ser. 33, pp. 96–97. figs.

7. 1909—*Ibid* U. S. Bur. Ent. Bul. 66, pt. VII, p. 95. Occurrence in Michigan.

8. 1920—FLUKE, C. L. Wis. Agr. Exp. Sta. Bul. 310. Life History Studies, etc.

9. 1920—BRITTAIN, W. H. Proc. Ent. Soc. of Nova Scotia for 1919, No. 5, p. 11. Plate figuring egg, larva, pupa and adult.

10. 1920—HEINRICH, Carl. Canadian Ent. V. 42, pp. 257–8. "The Pea Moth a New Species."

MR. ALVAH PETERSON: I would like to ask Mr. Fluke if he had any idea why he cannot control this pest by arsenical sprays. He probably knows that in the case of the Oriental peach moth, the young larva when it enters the fruit or the twig, refuses to eat the outer portion. Have you noticed the entrance of these larvae and did they have the same habit? If they have the same habit, I would say that this accounts for the fact that you cannot control this pest with arsenical sprays.

MR. CHARLES L. FLUKE, JR.: In Wisconsin pea fields, the seed is sown in no particular drilling method. About the time the pods begin to form, the vines mat together, and it is almost impossible to cover the pods entirely with spray. The infestation is not sufficient sometimes to detect whether it comes from the lack of eating spray, or some other cause. I do not believe I can answer your question positively.

PRESIDENT WILMON NEWELL: We will now listen to the next paper, "Observations on the Fall Army Worm and Some Control Experiments," by Roger C. Smith.

OBSERVATIONS ON THE FALL ARMY WORM AND SOME CONTROL EXPERIMENTS

By ROGER C. SMITH, *Manhattan, Kans.*

(Withdrawn for publication elsewhere)

MR. W. E. HINDS: This species occurred early in the season in Alabama. This year, every county in the state had two or three generations. The second and third generations cause the severe damage. Those in Kansas are probably due to migration from the southern area.

MR. GLENN W. HERRICK: I would like to ask if it is positively known that all of these hundred larvae were parasitized.

MR. ROGER C. SMITH: Yes.

PRESIDENT WILMON NEWELL: The next is a paper by W. J. Baerg, "A Girdler on Artichoke and Other Little Known Insect Pests."

A GIRDLER ON ARTICHOKE AND OTHER LITTLE-KNOWN INSECT PESTS

By W. J. BAERG, *University of Arkansas*

Mecas inornata Say (Order Coleoptera, family Cerambycidae). This beetle, half an inch long, of a light gray color, is a girdler that attacks artichoke (*Helianthus tuberosus*). The beetles begin ovipositing early in July. The females when laying eggs girdle the main stem about six inches from the top. Two girdles are made, about 1–1¼ inches apart. Immediately above the lower girdle is the egg puncture. This is exactly similar to the method followed by the Raspberry cane girdler (*Oberea bimaculata*). The girdles are not clean cuts such as we find in woody plants, but rather a series of holes encircling the stem. Apparently one female will deposit in a large number of plants. In spite of the fact that only a few beetles could be located, practically all the plants in the field were attacked in the course of a few days.

As a result of the injury, the leader in the plant dies and the plant develops a bushy type of branching.

The young larvae upon hatching begin to feed between the girdles and later proceed towards the base of the plant. They confine their injury largely to the pith. Apparently under certain weather conditions the artichoke is not well fitted as a host plant. In only one out of four or five plants showing egg punctures was there a full grown larva.

In most of the other plants the larva had begun to feed and some time later died, presumably it had been injured by the growing stalk.

The larvae attain full growth, that is about seven-eighths of an inch in length, some time in November. At this time the larvae are found at the very base of the stalk, about two inches below the surface of the ground, in an enlargement of the tunnel which has been padded with fine bits of pulp.

The pupal stage has not been observed but since the adults appear early in July, the larvae will presumably pupate some time in May or early in June.

It seems reasonable to assume that this species will attack most of the species in the genus Helianthus. None of these were near the artichokes, and no data have been secured. The only host plant other than artichoke that could be located is the common ragweed (*Ambrosia artemisiifolia*).

Haploa colona var. reversa Stretch (Order Lepidoptera, family Arctiidae.) The caterpillars appeared on strawberries early in April. In the neighborhood of Johnsons some beds were infested to such an extent as to make the injury very noticeable, about 10 per cent. of the foliage was destroyed. The larvae resemble in a superficial way those of the Peacock butterfly. They were nearly fullgrown on April 19. Specimens reared in the insectary emerged as adults about a month later.

Eleodes tricostata Say (Order Coleoptera, family Tenebrionidae). The life history of this species has been studied in Kansas and among several other species is recorded by Professor Dean as of "great economic importance". (Station Rpt. 1917–18). The larvae were sent in from De Queen and reported as damaging strawberry plants. An investigation showed that the larvae attacked the crown, and the roots immediately below the crown. It was only in new beds, such as had been set out that spring, where the injury appeared. The field in which the heaviest damage was observed was a piece of cleared woodland. Here the larvae destroyed fully 50 per cent. of the young plants over an area of several acres. Some of the larvae were taken to the Insectary at the Experiment Station and reared in Riley cages. The adults appeared late in July.

All the insects referred to in this paper were determined through the kindness of Dr. L. O. Howard, United States Bureau of Entomology.

Adjournment.

Section on Apiculture

(Wednesday Evening)

The meeting of the Section on Apiculture of the American Association of Economic Entomologists was held Wednesday evening, December 29, 1920, at the University of Chicago, and was called to order at 8.15 p. m. by the Chairman, Mr. F. B. Paddock of Ames, Iowa.

SECRETARY G. M. BENTLEY: It becomes my duty to introduce the first speaker of the evening, our Chairman, Mr. Paddock. He will address us on "Better Queens."

THE VALUE OF GOOD QUEENS

By F. B. PADDOCK, *Ames, Iowa*

Increased production and efficiency of production are terms which have come to mean a great deal to all of us during the last few years. Among beekeepers these terms have less meaning than among most any other class of producer. Several factors are needed to place honey production on a sound basis. To even enumerate the more important factors is without the scope of this paper. Only one factor is given for consideration; better queens.

During the past season observations have been made in an apiary which was originally composed of 60 colonies. The start was made by the purchase of 40 3-frame nuclei and 20 3-pound packages. All of the bees arrived and were installed about April 27. The queens were raised in the period just preceding shipment. In the two weeks following installation some queens were lost and such nuclei were distributed, a frame or so in a place, among the remaining nuclei. Since all the bees were in the same yard, all placed on foundation, all fed apparently equal, all given any and every attention possible, it can be said that the environment of the colonies was as nearly equal as it is possible to provide.

On June 6th an examination was made of the 14 colonies originating from packages and the 31 colonies originating from nuclei. A more or less arbitrary standard was used but the ratings were applied equally in every case. These were Excellent for those colonies with 6 frames of brood, Good for 5-frame, Medium for 4-frame in modified Dadant hive.

Of the package colonies on June 5th, 12 were rated as Excellent and 2 as Medium. The results of the season in honey gathered are shown in Table I. Of the 2 Medium colonies, 1 produced no surplus honey and 1 produced ½ super. A full modified Dadant super is taken to

yield 40 pounds of extracted honey. But little more could have been expected from these colonies although unlimited patience was shown toward them with the hope that conditions might improve.

TABLE I

20 colonies			
6 loss			
14			
2 Medium	1–0		
	1–½ super		
	2–½		
	2–1½		
	1–2½		
12 Excellent	5	6½ supers	
	5–3		
	2–4	23 supers	
		29 supers	

Of the 12 colonies rated as Excellent the results are as interesting as erratic. Two colonies produced ½ super each, two 1½ supers each, one 2½ supers, five 3 supers each and two 4 supers each. It will be seen that five of the twelve which were rated as Excellent produced less than the average or 1.3 supers each. On the other hand seven of these twelve colonies produced more than the average or 3 2-7 supers each. Then the seven colonies produced 3.6 times as much as the five, or 85 per cent of the total crop. If all package colonies had produced 3 supers each (the amount produced in 5 cases) the 14 colonies would have produced 42 supers of honey instead of 30 or an increase of 40 per cent or 480 pounds having a market value of $120. This amount of money was lost to the beekeeper the past season because all the colonies did not produce an average return.

TABLE II

40			
9 loss			
31			
1 Poor			
13 Good	7–½		
	4–1½		
	–2	=13½ supers	
	2– ¼		
	2– ½		
	4–1½		
	2–2		
17 Excellent	10	11½ supers	
	5–3		
	1–4		
	4–5	=24 supers	
		35½ supers	

Of the nuclei colonies on June 5th, 1 was rated as Poor, 13 as Good and 17 as Excellent. The results of the season in honey gathered are shown in Table 2. Needless to say the poor colony did not produce any surplus honey. Of the 13 good colonies, seven produced ½ super each, four 1½ supers each and two 2 supers each. Then the thirteen colonies produced 13½ supers of honey or an average of 1 7-13 supers each. Ample attention was given to these colonies but day after day did not bring the fond realization of the dream that tomorrow they would pick up and do well.

Again in those colonies rated as Excellent at the beginning of the honey flow the results were exceedingly variable. Two of these colonies produced ¼ super, two ½ super, four 1½ supers, two 2 supers, five 3 supers, one 4 supers and one 5 supers. Thus ten of the seventeen Excellent colonies produced below the average, a total of 11½ supers or 1.15 supers each. The other seven colonies produced above the average with a total of 24 supers, or 3 3-7 supers each. With these colonies as with the package colonies, the majority of those producing above the average produced 3 supers each. Only 33 per cent. of the package colonies produced the average amount of honey. The seven Excellent nuclei colonies produced an average of three times as much as the average of the other ten, or they produced 75 per cent. of the total crop of this class. If all the nuclei colonies had produced the normal of the best or 3 supers, the yield would have been increased almost 100 per cent. or 1760 pounds worth $440. In the entire yard the loss to the beekeeper by these low producing colonies was $560. There were 31 colonies involved in this loss or $18 was the loss on each colony. In other words each poor queen cost the beekeeper $18 in one season, the market price of one dozen queens at present.

Having stated the effect, is it possible to state the cause? The queens of either the 40 nuclei or the 20 packages were raised in the same yard and all the queens were doubtless raised at approximately the same time, since delivery was practically the same. On June 5th, or just previous to the main honey flow, the colonies were rated. The difference in the condition of the colonies at this time could be attributed to several causes, more or less within the control of the beekeeper. However, the cause at this date is the same as poor producing colonies and will be referred to later. This cause may not be so pronounced before honey flow begins.

Reference to Table 1 will show 12 colonies rated as Excellent on June 5th of which only 7 produced an average crop as indicated on August 5th. Reference to Table 2 will show 13 rated as Good and 17 as Excellent, of which only 7 produced an average crop. What can the answer be? Queens of a low producing type.

Queen breeders may take exception to this solution of the problem presented. However, the time is at hand when the beekeeper needs queens raised from a production record rather than color, gentleness, character of capping and several features now pointed to with pride by this or that queen breeder. In other forms of production we have a basis of reproducing from individuals of a known record. In the development of the 265-egg hen each progeny has been selected for breeding purposes on a basis of high performance. The same is true with dairy herds and racing horses. We now hear of poultry culling with the attendant "boarder hens" and we hear of the Babcock test with "boarder cows". Why not hear of pounds of honey and "boarder queens"?

The problem of improving the queens on a basis of production may be slow and uncertain but the improvement must come in bees as it has in the other animals. The problem may be complicated by the asexual development of drones and the inability to control mating. However, effort must be made to overcome the present indifferent production of queens. Individual selection will be required and progress at first will necessarily be slow.

In the meantime each beekeeper can help in this problem. Rate the colonies and check them closely. Any colony which does not come up to average should be requeened. Provide a queen reservoir so as to have queens to replace in case of accident or slump. In August requeen all colonies that are not up to the average. Such measures are only temporary at best. Improvement must be on a sound basis of heredity. The real solution of this problem lies in rearing queens on an individual record of performance basis.

MR. H. F. WILSON: I would like to ask if that was this year.

MR. PADDOCK: They were spring raised queens and arrived with the nuclei and packages approximately April 25th.

MR. WILSON: We had practically the same experience. There were twenty-seven queens out of ninety that failed, that is, died from one cause or another. I presume that you noticed practically every one of those colonies started to requeen itself.

We found in the case of package bees that every colony, practically, will start to supersede. We found, for instance, that when bees come in as early as April 20th, the loss will be from ten to fifteen percent. more than if the bees arrived on May first. I am just wondering whether or not we can figure correctly the value of queens that come in packages. That the queens should be tested out can not be questioned, but if those queens had not been shipped in, would the results have been as bad?

Last year we got packages about the first of May and we did not lose a single one, but this year we lost twenty-nine out of ninety. We attribute that to the fact that when it was cold the bees would not take care of them.

CHAIRMAN PADDOCK: The next paper on the program is "Some Apicultural Investigations" by Wallace Parks of Ames, Iowa.

SOME APICULTURAL INVESTIGATIONS

By WALLACE PARKS, *Ames, Iowa*

(Withdrawn for publication elsewhere)

MR. E. C. COTTON: I would like to ask Mr. Parks if he knows if those bees that made a few trips had larger loads than those that made many trips.

MR. PARKS: I am inclined to believe that in most cases the bees making very few trips were old bees.

CHAIRMAN PADDOCK: The next paper is by Mr. L. V. France.

THE PROBLEM OF CONTROLLED FERTILIZATION OF QUEEN BEES[1]

By L. V. FRANCE, *University Farm, St. Paul, Minn.*

This problem is without doubt the most important one which has to be solved before the pursuit of beekeeping, or industry, if it can be called such, may advance farther than its present stage. We know fairly well how to manage the honey bee, in her present more or less hybrid and variable condition, for surplus honey production. We are also able, after a fashion, to control the bee diseases and keep the winter loss down to about ten per cent. (10%). In an apiary of one hundred colonies of the purest breeding possible at present, we find a few colonies that surpass all of the others in honey production, gentleness, comb building and wax production qualities, resistence to certain diseases, hardiness, length of life, etc. For the *one single reason* that we are not able to control the mating of our queen bees we cannot keep and combine these desirable characteristics when they once appear in one or more colonies.

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An illustration of this occurred about 1906. E. R. Root discovered one of his colonies of bees working on red clover when all other colonies were doing nothing. Investigation showed that the tongue length of the bees of this colony was twenty-three one-hundredths (23-100) to twenty four one hundredths (24-100) of an inch while the tongues of ordinary bees are sixteen one-hundredths (16-100) of an inch to seventeen one-hundredths (17-100) of an inch in length. This particular sport colony degenerated back to the normal stock, although an attempt was made to save the long-tongue character. (E. R. Root, Jour. of Heredity, Vol 7, No. 1, Jan. 1916. Page 46).

The solution of this problem requires a knowledge of bee behavior and of the morphology and physiological reactions of the generative organs. The data of real value which are now available are meagre and it is apparent that a successful solution of this problem necessitates a very large amount of further study and investigation.

When we are able to definitely control queen bee matings, there will then be available for genetic or heredity studies an animal offering probably greater opportunities for results than has the fruit fly, Drosophila. This one possibility alone would be worth more to the people of the United States than all the honey produced in this country.

About 1800, F. Huber, in France showed that the queen bee is mated in the open air, on the wing, and that this fertilization may last for several years.

In 1745 Bonnet described parthenogenesis in plant lice. About 1845 Dzierzon in "Eichstädt Bienenzeitung" stated his theory that drone bees develop from unfertilized eggs.

The movable frame hive invented about 1851, Italian bees introduced from 1861 on, the honey extractor about 1860, comb foundation about 1857, a practical bellows smoker about 1865, and great crops of honey secured from bees created such an interest that the American Bee Journal began its publication in 1865 during the Civil War.

It was soon apparent that it was difficult to keep pure the Italian bees or any of the other races being introduced, Carniolan, Caucassian, and Cyprian especially, because of the almost universal presence of common black or German bees within a mile or so of any conveniently located queen breeding apiary. The desire also developed to produce breeding stock of the different races of bees, emphasizing gentleness, honey gathering qualities and color markings.

From 1870 to perhaps 1900 the dream of beekeepers as noted especially in the American Bee Journal was to control the mating of the queen so that races and strains could be kept pure and desired qualities obtained and propagated.

An investigation of the literature has given to us a list of about thirty references of attempts to control queen bee matings. These attempts are of two general types, *first*, enclosure of some sort to permit a more or less natural meeting place for a queen and a drone, including various small glass covered boxes on hives, tents and greenhouses, one of the latter being the largest glass building in America; *second*, the more or less forcible mating of the queen by bringing a queen and drone together and then forcing out the drone's organs by pressure on the abdomen, or by forcible injection of drone sperms or sperm fluid into the vagina of a virgin queen.

Considerable interest was directed towards Minnesota in 1914 when Jager and Howard secured one successful mating out of six trials by this last mentioned method, injection of sperms into the vagina of the virgin queen. In 1915 and 1916 however, Prof. Howard and myself secured only three partial successes out of fifty-five attempts and we concluded first that to continue further by that method would necessitate more study of the morphology and functioning of the sexual organs and second, that a different method would be more likely to yield immediate results. I tried a certain kind of a tent in a greenhouse at University Farm in 1918 and failed to mate the virgin queen used but secured some valuable data.

The latest and one of the most valuable contributions to the solution of this mating problem appeared in the Journal of Experimental Zoology for August 1920 in the form of two very excellent papers by G. H. Bishop of the Entomology Division, Wisconsin University, on the morphology and probable physiological functioning of the generative organs of the drone and queen.

It is our opinion that bee culture may have reached its probable development under the present conditions. Our so-called pure Italians seem at best to be something of a mixture. Controlled mating of queen bees will permit actual "pure" races and strains to be produced. When we have them, then with the proper breeding procedure it will be possible to create a honey bee that is uniformly gentle, hardy, long life period, great honey gatherers, resistance to disease, etc. on to our "ideal" bee for Minnesota and the Northwest.

I feel very confident that someone in the near future will devise some method whereby matings may be controlled. We expect the solution of that problem will give bee culture as great a step forward from its present stage as the invention of the movable frame hive did in 1851.

Finally we feel at times that if it were permissible and we could "get away with it" as so many seem to be doing just now, we would rob a bank, build a large, high domed green-house similar to the one in Como

Park, St. Paul, to permit a twelve months experimental period, and probably we might be able to make a contribution.

References With Brief Data

? H. L. Jeffrey. Confined in several hives of bees were some virgin queens and drones of selected stock. These hives had above the combs a space three to four inches high free and clear, to give the bees room in which to gather when being moved, it being the intention to take them some distance from other bees and there liberate them, trusting that the matings of the queens would be with the selected drones. The hives were moved by wheelbarrows, and on inspection at the end of the journey he found that all six queens had mated. Subsequent similar attempts failed. Mr. Jeffrey is credited with being a close observer. R. I. Agri. Exp. Sta. Report 1908—p. 306.

? W. E. Flower. Cage of mosquito netting about 15 x 15 feet. One successful mating. R. I. Agric. Exp. Sta., Report 1908—p. 307.

1873 J. Hasbrouck. Small glass covered box on hive. Many queens fertilized, also many failures. *Am. Bee Jour.* Vol. 14—1873.

1875 J. Hasbrouck. Small glass covered box on hive—three matings. *Am. Bee Jour.* Vol. 15—p. 519.

1875 Davis. Small glass covered box on hive—one mating. *Am. Bee Jour.* Vol. 15.

1875 Bagley. Small glass covered box on hive—one mating. *Am. Bee Jour.* Vol. 15.

1878 J. Hasbrouck. Small glass covered box on hive—several matings. *Am. Bee Jour.* Nov. 1878.

1881 Cramer. Small glass covered box on hive—two matings. *Am. Bee Jour.* Vol. 17, p. 19.

1881 Fincastle. Small glass covered box on hive—five matings. *Am. Bee Jour.* Vol. 17.

1882 Shuck. Queen tied to thread so she could fly only above the home apiary—one mating. *Am. Bee Jour.* 1882, p. 789

1884 Brown. Small glass covered box on hive—one mating. *Gleanings in Bee Cul.* 1884. p. 674.

1885 Cook. In hive. Queen had imperfect wings—one mating. *Gleanings in Bee Cult.* Vol. X, p. 544.

1887 McLain. Large tent—one mating of 6, later 3 of 6. *Am. Bee Jour.* Vol. 23, 1887.

1888 McLain. Large tent—six matings. *Am. Bee Jour.* Vol. 24, p. 487.

1887 McLain. Squeezing drops of sperm fluid from drone organ into vulva of queen—twenty-five matings. *Am. Bee Jour.* Vol. 23.

1887 McLain. Squeezing contents of seminal vesicles into vulva of queen—three matings. *Am. Bee Jour.* Vol. 23.

1887 McLain. Diluting sperm fluid with introduction into vulva—six matings. out of twenty-seven. *Am. Bee Jour.* Vol. 23.

1885–6 McLain. Various methods as above. Reports U. S. D. A. 1885 and 1886.

1887 McLain. Various methods as above. Reports U. S. Com. Agr. 1887.

1887 Hohenshell. Greenhouse—two matings. *Am. Bee Jour.* Vol. 23, 1887.

1887 Balch. Squeezing drops of sperm fluid from drone organ into vulva of queen. Had practiced this on defective winged queens for fifteen years. *Am. Bee Jour.* Vol. 23, 1887.

1901 J. S. DAVITTE of Aragon, Ga., used a tent of mosquito netting, 30 feet high and 30 feet in diameter. Colonies of bees containing selected drones and queens of mating age were placed at the bottoms of such enclosure with the outside entrance covered with queen excluding perforated zinc and an inside entrance opened from 11:00 a. m. to 1:30 p. m. on favorable days. *Davitte reported 100 successful matings.* This general plan has been tried by others but without success. One man used wire cloth instead of mosquito netting and the queens, drones and workers killed themselves on the screen. Davitte's cage was wrecked by a wind storm and not rebuilt. *Beekeeper's Review*, Feb. 1901 and R. I. Agri. Exp. Sta. report, 1908, p. 307.

1903 E. F. PHILLIPS. Glass covered vivarium, Univ. Penn. Nuclei containing drones and queens had outside entrances protected with perforated zinc and unprotected inside entrances. Drones were used that had never flown outdoors. Observations were taken from the rafters. The queens would soon strike the glass roof and alight and the drones would at once disperse, there apparently being no attraction in a queen at rest. No matings. *Beekeeping.* E. F. Phillips, 1915, p. 69–70.

1907–8 A. C. MILLER and L. J. COLE. A cloth tent nine feet square, nine feet high, double walled, the cloth walls one inch apart permitted bees to fly in apparently a normal manner. Several trials with no matings. The queens struck the top a great deal in flying. The drones did not strike the top but flew freely. It may be the drones failed to recognize the queen because of the presence of many flying workers or if recognized mating failed to occur because of unfavorable conditions, such as confinement and limitation of vertical space permitting reaction of the queen to the drone. R. I. Agr. Exp. Sta. Report, 1908. p. 306–311

1915 WILMON NEWELL. Controlled matings at isolated bee-free stations on the Texas Gulf Coast Prairie. Natural matings in the air. Successful crossing of Italians and Carniolans. *Science*, n.s. 41; No. 1049, 218-219.

1915 JAGAR and HOWARD. Diluting sperm fluid and using pipette to introduce the fluid into the vagina—one mating of six. *Science*, n.s. Vol. 40, No. 1037, p. 720.

1915–16 HOWARD and FRANCE. Diluting sperm fluid and contents of seminal vesicles of mature drones and introduction with pipette into vagina. Three partial successes of fifty-five. *Jour. Ec. Ent.* Vol. 11, No. 2, p. 265–267.

1915–1916. C. E. BARTHOLEMEW. Personal statements to C. W. Howard and L. V. France that he had at Ames, Iowa successfully mated several queens by forcing the contents of the drones sexual organs into the vagina of receptive virgin queens. This item unpublished so far as is known.

1917 GEO. D. SHAFER. (a) Virgin queen and drone were each fastened at end of a fine elastic wire holder. With wings buzzing queen and drone were brought face to face in the air. No matings from several trials.

(b) Forcing out drone sexual organs into vagina of queen. No matings from several trials. Tech. Bull. 34, Mich. Agr. Exp. Station.

1917 E. R. ROOT. "So far the only feasible plan for mating queens with select drones is to put perforated zinc over the entrances of all colonies not having choice drones, leaving only select drones to have the freedom of the air. A still better plan is to take the queen mating nuclei to an island where there is a colony containing select drones. This island should be located at least five miles from the mainland." 1917 Edition, A. B. C. of Bee Culture, A. I. Root Co., Medina, Ohio.

1917 H. H. & E. R. ROOT. Garden truck greenhouse. Largest glass building in America 600 feet long, 60 feet wide, and 30 feet high. No matings from 24 queens.

1917 H. H. & E. R. ROOT. "As a final word we give it as our opinion that while this experiment is not absolutely conclusive yet we feel that if mating under cover is ever accomplished the percentage of mating may be so low that the success will be interesting more from a scientific than from a practical viewpoint. In other words, while the queens and drones may fly naturally in a great enclosure like the greenhouse in which this experiment was tried, yet conditions nevertheless are not normal, as they are out of doors, and any possible successful matings will doubtless be limited. Yet having said this we are not quite prepared to add that this cannot be done. We may try the experiment again—indeed we are likely to try it again." *Gleanings in Bee Culture*, Vol. 45, No. 1, to 7; January-July, 1917.

1918 L. V. FRANCE. Round canvass tent, double walls, 4 feet in diameter, 7 feet high at peak with about 8 inches space between the canvas walls. A nucleus, containing workers, drones and a five day old virgin queen was placed in the tent and observations taken. No natural, mating flights occurred. The Virgin appeared to fly naturally in the tent, returning unaided to the hive, when removed from the nucleus and thrown into the air. The drones appeared to fly naturally, more so at first than after several days confinement in the tent. The queen failed to mate. Temperature ranged from 64 degrees F. to 92 degrees F. *Science* n. s. Vol. 49. No. 1255, January 17, 1919.

1920 GEO. H. BISHOP. Two methods used as in the past.

1. "Queen and drone held in juxtaposition and the extension of the drone's organs brought about by pressure on the abdomen."

2. "The seminal fluid of the drone was dissected out and injected with a pipette into the organ of the queen." No successful matings. *Jour. Exp. Zool.* 31; No. 2; Aug. 20, 1920, pages 225–266; 267–286.

1920 F. W. L. SLADEN. Mating queens successfully with selected drones on Duck Island, Lake Ontario. *Gleanings in Bee Culture*, 48; 80–82, 717–718, 1920.

CHAIRMAN PADDOCK: The next paper is by Dr. J. H. Merrill. Dr. Tanquary will read the paper.

FURTHER NOTES ON THE VALUE OF WINTER PROTECTION FOR BEES[1]

By J. H. MERRILL, *Apiarist*

Kansas State Agricultural College and Experiment Station

For the past three years an experiment has been carried on at the Kansas State Agricultural College to determine the best method of wintering bees. The results of the first two years' work were published

[1]Contribution No. 61, from the Entomological Laboratory, Kansas State Agricultural College. This paper embodies some of the results obtained in the prosecution of project No. 126 of the Agricultural Experiment Station.

in the JOURNAL OF ECONOMIC ENTOMOLOGY, Vol. 13, No. 1, pages 99 to 111. In this report it was explained that two series of hives were used in this experiment, one of which was placed in the open, and the other was placed so that it was protected by a dense windbreak. In each set there were used one one-story hive, one two-story hive, and another two-story hive, which was placed in a packing box and insulated with leaves, whereas the one-story hive and the two-story hive were left unpacked.

As a standard of what constitutes good wintering, it was decided that that colony which possessed the greatest number of bees at the beginning of the honey flow was the one which had wintered best. In the fall of the year, and again in the spring, by a system of weighing, and allowing 5000 bees to a pound, it was possible to very closely approximate the total number of bees in a colony and the amount of honey both in the fall and in the spring. The results for the first two year's work conclusively showed that a two-story hive gave better wintering results than a one-story hive. Since this was due to a greater depth, making it possible to leave more honey, and also provide room for clustering and spring brood rearing, then, for the same reason, a larger and deeper hive would be preferred even to a two-story hive, because it would have the extra room and depth in one set of frames. It was also shown that the difference between a packed and an unpacked colony was represented by about 25000 bees, or five pounds. With bees selling at $2.50 a pound, this would mean $12.50 saved by using the packing. The windbreak was shown to make a difference with the unpacked colonies of about 2500 bees. With the packed colony, however, the windbreak was not as valuable, showing that if a windbreak was not available, packing, to a large extent, would take its place.

Ordinarily, in the vicinity of Manhattan, Kansas, the elms begin blooming about the second week in March, followed by the soft maples, after which other spring flowers, that is, fruit bloom, etc., appear. Usually it would be necessary to leave only stores enough in the hive to last the bees until April, after which time, unless the weather is unfavorable, the bees will gather sufficient honey for spring brood rearing. The spring of 1920 was very cold and unfavorable. On the 5th day of April, the temperature at Manhattan dropped to five degrees above zero, killing not only the flowers which had already appeared, but so seriously injuring the buds as to prevent the later flowers from appearing. Consequently, the bees were obliged to subsist almost entirely on honey which was left in the hive in the fall.

The bees were put into winter quarters on October 4th, 1919, and the number of bees and amount of honey in each colony was computed.

During the winter, as each colony rested on a platform scale, daily weights were recorded. On the 19th of May, the packing was removed from the hives and the number of bees and the amount of honey in each hive was again computed. The 19th of May is two weeks later than the date when the spring weights were taken in 1919, and if the queens had been laying 3000 eggs a day, the colonies should have each had 42,000 more bees this year at the time of weighing than during 1919.

The results of the spring weighings in 1920 differed in a great many respects from the preceding years, and at first glance appeared to be unexplainable. However, as will be mentioned later, an examination of the weights taken daily very satisfactorily explained the seeming differences. As in the previous years, the two-story hive and the packed hive in the open were found to be far superior to the one-story unpacked hive. Also the windbreak was shown to be very valuable, as the colonies, with the exception of the packed colonies in the windbreak, were far superior to the similar colonies in the open. The most surprising discovery was that the packed colony had not gained as many bees as the unpacked colony. This was at first very disconcerting, but upon turning to the record card which contained the daily weights taken of these colonies, it was found that on the 19th of April, the packed colony had completely exhausted its winter stores, and from that time until the 19th of May the bees were obliged to subsist on what few flowers they could find. The one-story unpacked hive had been able to continue making its gains, due to the fact that on the 19th day of May it still had a considerable amount of stores left in the hive. Similar conditions were found with the packed colony in the open. It had gained over what it had in the fall, but in no way was this gain equal to that made by this same colony during the previous years. In 1918–1919, the one-story unpacked hive in the windbreak gained 313 bees, while the packed hive in the windbreak gained 24,844, but during 1919–1920 the one-story unpacked hive in the windbreak gained 10,000, while the packed hive similarly placed gained only 3700. In 1918–1919 the two-story hive in the windbreak gained 5936, whereas in 1919–1920 it gained 8125. In 1918–1919 the packed hive had 24331 more bees than the unpacked hive, but in 1919–1920 it had 6300 less. Had it not been for the fact that daily records of the changes of weights were kept, these results would have been very hard to account for, and the general opinion that packing was not always of value would have been justified. On the 19th of May, the unpacked hive had five frames of brood, whereas the packed hive had only about three, yet to all ordinary appearances, the packed hive was a good, strong one on the 19th of May, and to a casual observer it would appear that they had wintered well. However,

when the fact is taken into consideration that during the fall and the spring of the previous year this colony gained 24844 bees, and this year it only gained 3700, it can be seen that something was radically wrong. A clue to this condition is found in the fact that the one-story unpacked hive had five frames of brood, while the packed colony had only three. This would account for the weakened condition of the hive. It is a well known fact that when the honey flow stops, most queens cease brood-rearing, or at least let up in the number of eggs deposited. From the results obtained this year, we see that a very similar condition is brought about in the hive when the stores are becoming exhausted. The queen slows up in her egg-laying to such an extent as to greatly weaken the colony, yet not enough but what it will appear to the casual observer to have wintered satisfactorily. If the honey flow should begin early enough, this colony will then go ahead and develop into a strong colony before the season is over. However, the opportunity of gathering a large surplus that year has been lost, because the colony would not be ready at the time the honey flow began. As an indication of the amount of food that the bees consumed during the winter of 1919–1920, it might be stated that one colony between October 4th and May 19th consumed 52¾ pounds of honey, six pounds of sugar, and two Langstroth frames partially filled with honey. When the difference between the packed hives and the unpacked hives is taken into consideration for the first two years, then it would be a mere matter of arithmetical computation to obtain the number of bees that would have been in the packed colonies this year had they been as well provided with stores as the unpacked hives.

Some valuable lessons may be drawn from the results obtained in the spring weighings, among which are: (1) When a colony has insufficient stores, even though it may appear to winter well, it will not be up to its full strength at the beginning of the honey flow, owing to the fact that the queen ceases brood-rearing when stores in the hives are becoming scarce; (2) it emphasizes the fact that although packing is very valuable, too much emphasis should not be placed on this feature alone, and (3) the windbreak was again found to make a great difference in the number of bees in each colony at the beginning of the honey flow, but, as before, this result was not as noticeable in the packed hives as in the unpacked hives.

When considering the question of wintering bees, too much emphasis should not be placed on any one feature alone. We know that we must have a large number of young bees; that we must have plenty of stores, and also that if we can give our bees the added value of a windbreak and winter protection, it will well repay us, but no beekeeper should

rely on any one of these factors alone and expect to get the very best results. They are all necessary.

CHAIRMAN PADDOCK: The next paper on the program is by Frank C. Pellett.

SOME BEEKEEPING PROBLEMS FOR EXPERIMENT STATIONS

By FRANK C. PELLETT, *Hamilton, Ill.*

The experiment stations are justly entitled to a large share of the credit for the great advancement of agriculture during the past few years. Unfortunately, as yet, few stations recognize the problems of the honey producer as of sufficient importance to engage their serious attention. Iowa and Texas are the two outstanding exceptions, for in these two states full time men are devoting their undivided attention to research work. However, in both cases, the work is new, and sufficient time has not yet elapsed to get far with the problems at hand. In several other states some research work is under way in charge of the entomologist or of some one on the staff who devotes a portion of his time to beekeeping.

For the most part the progress of apiculture is to be credited to the work of enthusiastic beekeepers who have made accidental discoveries and to well trained men who have taken up beekeeping as a hobby. The results obtained by the staff of the Bureau of Entomology of the U. S. Department of Agriculture, in their wintering experiments and in their research work on bee diseases, would surely indicate that beekeeping offers a promising field.

Since beekeeping is now receiving more favorable notice from the colleges of agriculture and state experiment stations, as evidenced by the fact that in more than thirty states some work in beekeeping is now under way, it may be an opportune time to point out a few of the problems which might profitably be undertaken.

The two problems which have received the most attention, wintering and bee diseases, may be mentioned. While much has been learned concerning the activities of the bees in winter and the fundamentals that must be observed, there is still a lack of such information as will enable the average beekeeper to apply these principles to his specific conditions. In every state it should be possible to give the enquiring beekeeper definite information as to the best method of wintering in his particular locality. Kansas is just now making an attempt to work out this information for the beemen within her borders.

We owe much of our information relating to the cause of larval diseases of the bees and their treatment to the Bureau of Entomology, although valuable information concerning the treatment was worked out by practical beekeepers. This knowledge came just in time to save the industry. There are, however, apparently, several diseases of the adult bee which at times cause heavy losses. We do not know, as yet, whether there be one or two, or a dozen of these diseases, nor do we know the cause. There is room for much work in this direction.

Some Practical Questions

In the sixties much interest was aroused in the possibility of securing a better race of bees than the black bees then common in this country. The Italians were imported and given much attention on the part of the bee magazines and the leaders in the beekeeping field. They proved to be much superior to the others and have been gradually replacing them since that time. For a number of years this interest in new races of bees continued and several men made long journeys to Europe or Asia in search for better bees. Cyprians, Egyptians, Caucasians, Carniolans and several others have been brought to this country at one time or another and given a limited trial. Perhaps the general introduction of these bees into the apiaries of the country, where they were left to chance in most cases, may be a sufficient trial. It would seem, however, that it might be quite possible that the best race of bees for California would not prove equal to some other for New England. There are several varieties of the honeybee which should be given an extensive trial under different climatic conditions to ascertain their possible value for America.

The problem of improving our best strains by selection and breeding should receive serious attention. One season, in the writer's apiary, there was a colony of Italians that continued to store surplus honey during a period of dearth when the rest of the apiary was doing little and some colonies were requiring feed to keep them from starvation. These bees were found to be working freely on a field of red clover near by. The tongues of bees from this colony were found on measurement to be slightly longer than any others in the yard. Whether or not this fact explained the greater prosperity of the colony, it continued for a period of three successive summers to store far more honey than any other in the apiary. The control of male parentage and the influence of the male parent upon the honey storing proclivities of the progeny may well receive some attention.

The cost of wax production to the bees has received some consideration from time to time. While it undoubtedly requires more honey under

some conditions to produce a pound of wax than is required under others, the results so far obtained have shown such a great variation as to be of little value. It would seem to be well worth while to undertake an exhaustive series of experiments under different conditions to secure further light on this point.

Conditions that control nectar secretion are, perhaps, just now, attracting more attention than any other. Too often the beekeeper looks forward to a bountiful harvest when he sees that an abundant bloom is assured, only to be disappointed. Last fall the Dadant bees were moved for a long distance to the fields of Spanish needle which bloomed profusely but yielded little nectar. At the Iowa station, some work along this line has been undertaken and two bulletins have been issued.' However, very little is known on this problem which is of first importance to the beekeeper. The importance of the project certainly justifies intensive experiments in an effort to ascertain the particular factors which determine the flow of nectar. Enough is known to make it apparent that these vary with different plants.

In some sections, notably in the Appalachicola River region of Florida and the Uvalde region in Texas, there are times when there is a shortage of natural pollen. At such times the beekeeper finds it hard to build up his colonies in preparation for the honeyflow and sometimes even to keep them alive. Beekeepers generally have an impression that rye meal or similar substances will serve as a substitute for pollen. Those who should be in a position to know, however, state that these are of no value to the bees and may even be injurious. A careful study of this whole problem looking toward finding some way to enable the beekeeper to meet such conditions would be extremely valuable.

A very long list of problems might be outlined, but the fact is that we know very little about bees as yet, and one does not go far in any direction until he meets a question mark. Because so few trained men have become interested in the subject, our knowledge of equipment and management is far in advance of our knowledge of fundamentals. With more than thirty institutions taking an interest we may expect that many of these perplexities will be explained.

MR. C. O. SMITH: I would like to ask if there has ever been any effort to ascertain the cost to the bee of ripening the honey?

MR. PELLETT: Not so far as I know.

CHAIRMAN PADDOCK: We will proceed with the next paper, which is the first number in the symposium on foul brood and is by Mr. S. B. Fracker.

STOPPING THE DISTRIBUTION OF AMERICAN FOUL BROOD AT ITS SOURCE

By S. B. FRACKER, *Madison, Wis.*

The danger of the introduction of diseased material into clean territory has been well recognized in the case of all animal and plant diseases. For some reason it seems to have been given less attention in the case of bee diseases than of insect pests and live stock troubles. Thus far the only attempts which have been made, except in one or two states, to control the movement of apiary material which may be infected but is not known to be, are in the nature of inter-state quarantines. The failure of the latter, in the case of the distribution of bee diseases, is notorious, and is due almost entirely to the manner in which bees and bee supplies may be shipped and moved about freely inside of state limits without restriction. Unless employees of transportation companies develop the habit of looking for inspection certificates or permit tags of some kind in every case where bees are moved or shipped, they cannot be expected to be particularly careful when the movement is inter-state.

This matter has been brought with particular emphasis to the writer's mind recently by a couple of incidents. One was the story of a certain county in one of the Mississippi Valley states in which an area cleanup campaign had been attempted, based more on the cooperation of the beekeepers than legal authority in that particular state. Great progress was made in freeing the county from bee diseases in two years, but in the spring of the third year a large heavily infected apiary moved into the center of the county. For various reasons no further work was done in this area and the inspector who had been in charge of the area cleanup, states that the county is probably in as bad shape now as when the cleanup was begun.

The other incident related to the control of tuberculosis in live stock, in which the county cleanup method is also being attempted. According to one of the representatives of the U. S. Bureau of Animal Industry that Bureau is refusing to cooperate in the area cleanup of tuberculosis as long as the unrestricted movement of cattle to and fro across state and across county lines is continued. If the necessity for the regulation for the movement of material subject to infection is apparent in the case of bovine tuberculosis, it must be doubly so in the case of foul brood in apiaries, for tuberculosis is not, according to the veterinarians, distributed to any extent through the air, and does not spread from one herd to another in adjoining fields unless they are nosing along the same fence.

Under the area cleanup system of foulbrood control, as shown in papers published elsewhere, from thirty-three to sixty-six percent. of all the diseased apiaries in a county clean up completely the first season. Something over one-half of the others free their apiaries from the last traces of disease during the second season, and the few remaining require somewhat drastic action on the part of the inspectors during the third. In the meantime clean apiaries do not in our experience acquire infection in any appreciable numbers during an area cleanup campaign.

Practically every state apiary inspection law prohibits, as that of Wisconsin did for over twenty years, the movement of material which the beekeeper knows to be infected. Directly in the face of this provision, however, American foul brood has spread from state to state and county to county until the serious condition which is facing all the upper Mississippi Valley states has developed. With these regulations in force, 35 to 45 per cent. of the apiaries in Jefferson, Milwaukee, Manitowoc, Calumet, and Dane counties, Wisconsin, became infected with American foul brood. At the same time an even more serious situation developed in three or four counties northwest of Milwaukee, and along the Wisconsin river in Richland and Sauk counties. In parts of these areas beekeeping has been practically abandoned as a result of the losses from disease.

When the Wisconsin apiary inspection law was rewritten in 1919, the problem of controlling the transportation of diseased apiaries was very clearly in mind. It was not felt practicable to require an *inspection certificate* for the movement of all used apiary material and all bees in the state. The expense of sending inspectors to all parts of the state, in case bees are to be moved only short distances or from one point to another in heavily infected territory, would be disproportionately expensive. At the same time it seemed to be undesirable to attempt to handle the problem by means of regulations which would specify that bees could be moved either (a) less than six miles or (b) within the same county, or some provision of that kind because of the fact that such a regulation would be as impracticable to enforce as the old one.

The method finally agreed on by the members of the State Beekeepers' Association who interested themselves in this problem, and by the State Department of Agriculture, was that of requiring a permit from the state inspector in order to sell, give away, or move bees or used bees supplies under any circumstances. The apiary inspector was then given power to refuse to issue such permits whenever there seemed danger of the distribution of disease or until it was determined by inspection that the apiary or material was free from disease. This regulation applies to transportation companies as well as to beekeepers.

Application blanks were devised, making request for certain information in regard to the material to be moved. These were rather widely distributed throughout the state to officers of the county associations and to beekeepers who were likely to desire to move bees. When an application is received, either the permit is immediately granted and sent by return mail, or the application is referred to a local inspector who makes an examination of the apiary.

The regulation has now been in force for eighteen months. During 1920, 420 applications have been received, of which 26 came from beekeepers in southern states who desire to ship package bees to Wisconsin under the federal postal regulations, inspectors being lacking in their respective states. These were granted for the one season of 1920, but all states who engage in shipping bees, except Alabama, have now arranged for inspection for 1921. Of the remaining 394 which were from Wisconsin beekeepers, all were granted except six which were refused on account of the serious danger of the distribution of the disease, two withheld for some months pending treatment and re-inspection, and five withdrawn by the applicant.

These figures are particularly interesting from a practical standpoint, as of course no information could be secured in advance in regard to the magnitude of the problem of controlling local movements of apiary material. We now know that if the clerical and inspection staffs are organized in such a way that from 450 to 600 applications can be handled per year, about one-half of them coming in between March 15 and June 15, the problem can be handled satisfactorily.

In Wisconsin permits are granted immediately upon receipt of the application in the following cases: (a) Apiaries in clean or moderately clean territory which have been inspected and found free from disease within the past twelve months; (b) apiaries in heavily infected territory which have been inspected during the same season and found free from disease; (c) regardless of disease conditions, if the movement is to be less than three or four miles; (e) for the shipment of old comb to foundation factories in tight containers during December, January, February, and March.

Outside of these classes special inspections are made. The latter have been such a small porportion of the total, however, that the total cost of making special inspections has been about $234.60, while the total cost of handling the clerical work has been even less. The number of applications from apiaries which were inspected during the season, either as a result of special application or in the regular course of inspection, was 165.

The distance in many cases was small, about half the applications covering distances of less than five miles. If we omit the record of one apiary which was moved to California, another sent to Pennsylvania, and the shipments of comb to southern Illinois, the average distance was 32.4 miles per application. The average number of colonies to be moved was 18, and the average size of the apiary from which the material came was 52. These figures are surprisingly high when it is recalled that the average Wisconsin apiary contains 16 colonies but this is due to the large number of permits issued to commercial apiaries for the usual spring and fall transportation between outyards and the wintering location.

The support of the regulations on the part of the average beekeeper has been surprisingly encouraging. Occasionally delays, caused by the loss of applications or permits in the mails and similar incidents, have caused inconvenience, and in at least two cases beekeepers have suffered small financial sacrifices, owing to their desire to move material within twenty-four hours and the obvious impossibility of procuring a permit within that time. In one of these cases the apiary proved on subsequent inspection to be heavily infected, while in the other it was healthy.

Blanket permits covering more than one sale or movement have been given in only a very few cases. These are to beekeepers who make a business of supplying bees and equipment, as well as producing honey. This is not an extensive business in Wisconsin and it is understood that such permits for the sale of bees or queens will never be given except in annually inspected apiaries surrounded by large areas of clean territory.

The necessity of making special inspections has required the development of a special staff of local inspectors of whom 25 have already been appointed. The usual method is that the county beekeepers' association recommends three of its members, who then take a civil service examination in which the primary weight is given to experience and training. In most cases the department has been fortunate in securing men whose apiaries have been infected with American foul brood and who have successfully cleaned it up. Many of these county inspectors are employed only a day or two each season and five had no work at all during 1920.

We may conclude by answering one question which is always a matter of interest, namely what percentage of the actual sales or movements of bees does the department reach? In order to determine this point and assist in the administration of these provisions, a staff of about 200 volunteer correspondents has been developed who report all movements of apiary material of which they hear in their respective neighborhoods. During the season, out of 150 reports, it was found that all but 8 or 10

of the beekeepers who were reported selling or moving bees had permits. The remainder were warned and, in case any damage resulted to nearby beekeepers, prosecuted and fined.

After one season's administration of the control of bee disease by stopping such distribution at its source, namely, the infected apiary, the beekeepers show no desire to return to the former free movement of infected and uninfected material. On the contrary, there are many letters on file in the office indicating that beekeepers whose living depends on honey production feel safe for the first time. They believe that even if American foul brood territory is within a dozen miles, the regulation of the movements of bees will keep the disease from spreading and they hope that eventually the area cleanup method of control will eradicate it completely.

CHAIRMAN PADDOCK: We will have all of the papers in the symposium before the discussion. The next is by Dr. M. C. Tanquary.

LEGISLATION FOR CONTROL OF FOULBROOD

By M. C. TANQUARY, *State Entomologist; Chief, Division of Entomology, Agric. Exp. Station, College Station, Texas*

I do not know in just what way the program committee intended for me to discuss the question of legislation for control of foulbrood. But since we are all interested in the control, and if possible, the eradication of bee diseases in any way possible, I am assuming that the committee intended that I should discuss the part that legislation might play in bringing about the desired end, and to give in general some of the important points that should be embodied in legislation for this purpose.

I wish to say in the beginning, that the statements made in this paper refer only to American foulbrood. We have very little or no European foulbrood to contend with in Texas, and therefore I think it advisable to leave the discussion of any special legislation referring to European foulbrood to those states in which that disease is a menace. I believe, however, that the laws should be so worded (and in every instance I know of that is the case) that the person in charge of the work would have authority to deal with all bee diseases.

RELATIVE MERITS OF EDUCATIONAL METHODS AND OF REGULATORY METHODS

Through correspondence and conversation with persons interested in this subject I have learned that there are in general two methods of

approach that are advocated for foulbrood control—the one being through education and the other through the adoption of legal measures for the control and eradication of disease. Some advocate chiefly the one and some chiefly the other. The very firm belief of the writer is that either measure without the help of the other will be a failure. The reasons for this belief are fundamental. Perhaps in a great many cases educational measures might be all that would be necessary. In other words, if all the beekeepers are made to understand the nature of bee diseases and to know the possibilities of these diseases as a menace to the beekeeping industry, they would be only too glad to take advantage of this knowledge and to use the proper methods for eliminating or reducing to a minimum all loss from such diseases. But because of certain elements which go to make up the sum total of human nature, there will always be a number of beekeepers or perhaps I should say people owning bees, who either through carelessness, indifference, or possibly through the possession of even more undesirable traits can be handled in no other way than by the arm of the law, and this number will always be large enough to prevent the eradication and complete control of bee diseases through educational methods alone. Even this perhaps comparatively small percentage, which refuses to be influenced by educational methods, is in actual practice reduced to a still smaller percentage by the knowledge that if they fail to be affected by the educational doses, a still stronger medicine may be administered in the form of legal compulsion.

As to the educational methods which may be used, I would say that every educational agency which can be brought to bear upon the problem should be employed, such as courses in beekeeping in Agricultural Colleges, state and county beekeepers associations, extension service, farmers' institutes, special schools in beekeeping, printed reports, circulars, bulletins, etc.; but in addition to all this, and I believe of even greater importance than all this, the men who go out to do the inspection work and control work generally, as authorized by the law, should be men thoroughly competent to do whatever educational work is necessary and should be men who would go out with the attitude of being friends and helpers of the beekeeper rather than with the attitude of one who goes out merely to do police control work. He should fall back upon the authority with which he is armed by law, only as a very last recourse, but in case it is necessary to attain the desired end he should use his authority to the fullest extent. The methods followed will naturally differ somewhat with the different people whom the inspector meets. It can be seen from the foregoing that the inspector should be not only a man competent to do the educational work, but he should be

a man who is actually interested in the welfare of the beekeepers. He should have abundant tact to get along with all sorts and conditions of men, and courage to face squarely unpleasant situations. I cannot emphasize too strongly the importance of the right qualifications in the men who are sent out as bee inspectors, because upon them will depend the success or failure of any method that is used.

Organization for Foulbrood Control

A discussion of the qualifications of a bee inspector brings up the point of the entire organization for foulbrood control work. Here again I find, through a perusal of the foulbrood laws of most of the states that have such laws, that there are in general two methods, that of county organization and that of state organization. For example, in a number of states the county commissioners of a county may, upon request of a certain number of beekeepers within the county, appoint an inspector and deputies to inspect the bees in that county. In one state such inspector is supposed to inspect all colonies of bees in that county between May 1 and June 15 of each year and is to receive no compensation except such as may be contributed by interested persons. Such a condition of affairs of course reduces the matter of bee inspection and disease control to a farce. There are a number of reasons why county organization alone is unsatisfactory. For one, in probably at least nine cases out of ten the county commissioners would not be able to judge of the qualifications necessary in a bee inspector; for another, such an arrangement hopelessly ties up the matter of bee inspection with county politics, for another in many counties a man suitably qualified for the position would not be available, for another there would be no uniformity of procedure among the counties of the state, and for still another there would probably always be counties in which there would be no inspector appointed, but which would contain foulbrood and consequently always be a menace to the beekeeping industry in the rest of the state.

Taking into consideration the above statements, the conclusion is drawn that county organization is bound to be ineffective and unsatisfactory.

State organization is more desirable for the following reasons:

1. The work can be handled more uniformly, more effectively and more economically.

2. The work is put beyond the influence of local politics.

3. The position of inspector is made a much more important one and consequently men with better qualifications are attracted to it.

4. The work of the inspector can be more definitely correlated with educational work along beekeeping lines being done in the state.

5. The suggestions given by a state inspector are almost always given more consideration by the beekeeper than if they came from one of the beekeeper's neighbors.

6. There are often personal reasons why a local inspector would hesitate to take the steps which he would realize would be necessary in order to clean up foulbrood in his county. Such reasons would not be present in the case of the state inspector.

7. By means of a state organization a general program extending over a period of years could be mapped out, looking toward state wide eradication.

In some cases a combination of local inspectors working with the state organization may be used to advantage. In these cases the local inspector should serve especially one or more of the following purposes:

1. To act as a scout to detect first outbreaks of disease in his territory.

2. To make the necessary inspections in the event of bees being moved into or out of his territory.

3. To answer "Hurry up" calls for inspection in his locality in the event a state inspector is not available at the time.

Local inspectors for the above purposes are particularly useful in large states in order to save time and expense in travelling. I see no reasons for confining the work of a local inspector by county lines, or for that matter by lines of any kind within the state, excepting in a very general way. I do not believe that the local inspection should necessarily be given to any one man. The person who has charge of the state inspection work should have power to deputize any qualified beekeeper at any time to make any necessary inspection in his locality. By such an arrangement, some one would always be available in any part of the state for inspection work. The successful use of this plan would of course necessitate a wide acquaintance among the beekeepers of the state on the part of the person in charge of the work, but the nature of his work would naturally bring this about.

During the past year we have had in Texas an excellent opportunity to compare the results of the county inspection system with those obtained by sending inspectors out from the office. One man on the staff, Mr. C. S. Rude, gives all his time to foulbrood control work. In addition, this year we added to our force in June three young men who had taken one or more courses in beekeeping in the Texas A. & M. College and who had had excellent training for this kind of work. Two of these men were graduates of the college and the other ranked as a junior in college. These men were sent to those parts of the state where there was greatest need for inspection, regardless of whether there were county inspectors there or not. We were extremely fortunate in that Mr. Rude and the three assistants all possess to a very marked degree those quali-

ties which I mentioned above as being necessary in a bee inspector. The results could hardly have been more gratifying. Their work was thorough and they received the heartiest cooperation from the beekeepers themselves. When asked their opinion concerning the method, almost without exception the beekeepers endorsed the plan. Many of the county inspectors welcomed this plan, saying that they would much prefer putting in all their time on their own work. Many of these county inspectors are men with a big beekeeping business of their own, and they have done the work of county inspection more because of their interest in keeping foulbrood down in their locality than because of what they got out of it in the way of salary.

The following few instances may be given of the results of this year's work in Texas under the present plan. In one county a beekeeper a few years ago owned several hundred colonies. Foulbrood got into his yards and he finally had less than twenty colonies left. He had given up the idea of staying in the beekeeping business. One of our inspectors spent a little over two weeks in his county and had every case of foulbrood in his locality treated or destroyed. This man then declared that he had changed his plans entirely and intended now to go into beekeeping on a big scale. Another beekeeper who lives in a county which has had foulbrood for many years made the statement publicly that "In our county we might have said in the past that Inspectors come and Inspectors go but foulbrood stays on forever, but now for the first time we feel that we have foulbrood on the run." A spring inspection of his county revealed 200 cases of foulbrood. A thorough fall inspection revealed but three cases, two of which were destroyed and the other treated by the inspector. Just a few days before I left the office I received a letter from two of our state inspectors in the southern part of the state saying that they had discovered a foulbrood nest in that section. One man owning 93 colonies had 74 diseased, and there were also other cases of disease near him. This report came from a county which has a county inspector and which has been reported free from disease for several years past excepting for one case which appeared in the inspector's own apiary and which he destroyed. Many other similar instances could be mentioned, but I think those given are sufficient.

Many of the county inspectors are good beekeepers and good inspectors and have done most excellent work. The fact some of them have not been able to locate and eradicate all the foulbrood in their county or counties (some of them have more than one county) is not necessarily a reflection on their ability but is more a reflection on the system. The better beekeeper and inspector a man is, the greater his loss if he puts in his time inspecting other people's bees instead of taking care of his

own. One of our best inspectors was absolutely unable, because of the rush of his own work, to do any inspecting whatever this year at a time when another beekeeper in his county had to have 1864 colonies of bees inspected in order to move part of them out of the state temporarily.

With the idea of its leading perhaps to greater uniformity of foulbrood legislation in the various states where beekeeping is of importance, I am submitting a list of points which I feel should be considered in forming a model foulbrood law. These points are not given in legal phraseology, but are given in such a way as to be merely suggestive rather than complete. I have arrived at these conclusions through a perusal of the foulbrood laws of most of the States of the United States and through the experience of working with our own law in Texas. I will say that there are a number of state laws at the present time which embody most if not all of the points here given.

Thirteen Points Offered as Suggestions in the Forming of a State Foulbrood Law

1. The organization for foulbrood control work should be a state organization and should be of such nature that local agencies or organizations could be utilized in case it is found desirable.

2. The entire organization should be as far as possible removed from state and local politics.

3. The work should be as closely as possible connected with educational and investigational work in beekeeping.

4. Provision should be made in the law whereby the person or group of persons having charge of the work might make whatever rules, ordinances or regulations are deemed necessary, and these rules, ordinances and regulations should have the full force and effect of law.

[I consider this one of the most important points of all. By means of this provision, new regulations may be made from time to time as the progress of the eradication should prove necessary or advisable. A number of the best state laws have such provision.]

5. Provision should be made for prohibiting the shipment into the state of anything capable of transmitting foulbrood.

6. Provision should be made for prohibiting the movement or shipment within or from the state of anything capable of transmitting foulbrood.

7. Inspectors should be authorized to enter any premises during reasonable hours for inspection purposes or for dealing with any article capable of transmitting foulbrood.

8. Queen bees and attendants should be shipped only from apiaries free from disease.

9. Violations of the law, or of the rules, ordinances and regulations made in accordance with the law, should be made subject to heavy penalty. Interferring in any way with the work of the inspectors should incur heavy penalty.

10. The person or persons having charge of the work should have ample authority to deal with all diseased material as he or they deem best under the circumstances. No compensation should be allowed for destruction of diseased material, or material which for any reason is a menace so far as bee disease is concerned.

11. Selling, giving away, bartering, owning, keeping, or exposing to other bees, any diseased material should be made unlawful.

12. The person or persons in charge of the work should have authority to require that all bees be kept in movable-frame hives. In case of refusal to transfer, authority should be given to order the destruction without compensation to the owner of all colonies not kept in such hives.

13. Sufficient funds should be available to make the foulbrood eradication work effective throughout the state.

CHAIRMAN PADDOCK: The next, by Mr. A. P. Sturtevant, will be read by Mr. Ernest R. Root of Medina.

MIXED INFECTION IN THE BROOD DISEASES OF BEES

By ARNOLD P. STURTEVANT, *Specialist in the Bacteriology of Bee Diseases, Bureau of Entomology, United States Department of Agriculture*

The two principal brood diseases of bees, European foulbrood and American foulbrood, heretofore have not been found associated together commonly in the same colony. The generally accepted belief has been that it is indeed a rare occurrence to find both diseases under these conditions. Sacbrood, on the other hand, is much more often found in greater or less quantity associated with either European foulbrood or American foulbrood, but seldom assuming dangerous proportions, either alone or in conjunction with the others. Statistics for the past few years, however, show that these cases of what may be called mixed infection are probably more common than was previously supposed and may account for some of the puzzling instances where colonies have not responded to treatment in the customary manner, thereby causing beekeepers to believe they have some new form of brood disease, or that the disease is showing some new unheard of characteristics.

Cases of so-called mixed infections are not at all uncommon among human diseases. Where this condition occurs, such as when a person affected with typhoid fever develops pneumonia at the same time, it is always the individual to whom the term mixed infection is applied. It is a somewhat different matter in the case of the brood diseases of bees. In the first place, so far as is known, the organisms causing these two diseases, *Bacillus larvae* of American foulbrood and *Bacillus pluton* of European foulbrood, have never been found together in the same individual larva. It is, therefore, the colony as whole which is to

be considered as the individual unit, as is the case in the majority of the manipulations of beekeeping practice. This fact makes the problem slightly different from a case of mixed infection as considered from the point of view of human medicine. However, since different individuals are involved in the mixed infections there is no "a priori" reason for considering such cases as impossible.

The first published report of an authentic instance where both American and European foulbrood were found together in the same comb from a diseased colony was reported by McCray.[1] This report was concerning a sample (4982) received at the laboratory for diagnosis May 4, 1916, from Stanislaus County, California. Previous to this case only one other such sample (2598 from Brown County, Wisconsin in 1911) had been received for diagnosis, showing the presence of both diseases, but no report concerning it was published. These two samples were the only known authentic cases on record either in the Bee-Culture Laboratory among practically 5000 samples received up to 1916, or in the beekeeping literature. These two cases were considered to be interesting in that they demonstrated that the presence of both diseases at the same time in a colony was possible, but not much importance was given the matter because of their rare occurrence. White[2] states that "such a double infection has been encountered in the writer's experience very rarely. In such diagnoses, therefore, after European foulbrood had been found in the sample, American foulbrood is seldom looked for." This practice has been the custom generally as well when American foulbrood was found present in a sample, no further search for European foulbrood being made unless there were present strikingly prominent symptoms abnormal for American foulbrood. As a result the diagnostic records of the Office of Bee-Culture show but six cases of mixed infection up to December 31, 1918, among the approximately 6000 sample records.

Developments during the year 1919, however, showed that mixed or double infection is more probable than had been previously supposed. These facts were particularly impressed upon the writer during the spring of 1919 while on a trip investigating the bee disease conditions in the State of California. While in the field during a period of less than one month, and in three different counties of the State of California, six cases were found showing both American foulbrood and European foulbrood in the same colonies. Each case was diagnosed positively at once in the field by means of microscopic examination of dead larvae showing characteristic symptoms of the two diseases and found to contain the specific causative organisms. It is interesting to note that three

[1]McCray, A. H. 1916. Report of the finding of American Foulbrood and European foulbrood in the same comb. JOUR. OF ECO. ENT. Vol. IX, p. 379.

[2]White, G. F., 1920. European foulbrood. U. S. Dept. of Agric. Bul. 810.

of the six samples were found in Stanislaus County in the same locality as the sample reported by McCray in 1916. These cases were all found in regions where both diseases are exceedingly prevalent and of long standing. A few of the samples were fairly self evident from gross appearances, but the majority required a more minute examination.

From that time on, particularly after returning to the laboratory in Washington, more careful examination was made, both gross and microscopic of all samples received because of suspicions aroused by the unusual prevalence of the obvious cases found in California. This was done in order to eliminate the danger of overlooking cases where one disease might be predominant over the other, whether both diseases were suspected or not, causing the less prominent to be overlooked.

As a result, during the remainder of the year 1919 from June until December, twelve more such samples were received in the laboratory from various parts of the country, (18 in all for that year, total 24) all of which proved upon careful diagnosis to contain both American foulbrood and European foulbrood in the same sample of comb. Furthermore, during the year 1920, up until November 15th, fourteen more such samples were received, making a total in all of 38. Tables 1 and 2 give the data from sample records.

TABLE I.—CASES OF MIXED INFECTION FROM LABORATORY RECORDS

Date	Lab. No.	State	County	Apparent primary invader from gross appearance	Remarks
9-20-11	2598	Wisconsin	Brown	?	Diagnosed by G. F. White
5- 4-16	4982	California	Stanislaus	American fb.	Diagnosed by A. H. McCray
6- 3-16	5061	California	Stanislaus	American fb.	Diagnosed by A. H. McCray
5-16-17	5392	Missouri	Jasper	Probably Afb.	
5- 9-18	5836	Mississippi	Washington	?	Apparently about equal
10- 9-18	6122	Wisconsin	Barron	?	More Efb than Afb
4-19-19	6437	California	Santa Barbara	Probably Efb.	One cell Afb.
4-26-19	6441	California	Sacramento	American fb.	From history of case
4-26-19	6442	California	Sacramento	American fb.	
4-28-19	6445	California	Stanislaus	European fb.	Few cells Afb.
4-30-19	6449	California	Stanislaus	American fb.	Few cells Efb.
5- 1-19	6452	California	Stanislaus	European fb.	From history of case
5-20-19	6304	Missouri	Lewis	?	
6-11-19	6401	Ohio	Ashtabula	?	
6-27-19	6498	Iowa	Johnson	American fb.	Efb early stages, also Sachrood
8- 1-19	6629	Ohio	Trumbull	?	
8-15-19	6672	Connecticut	Tolland	Probably Efb.	Afb slight amount
8-25-19	6698	Kansas	Cherokee	?	
8-29-19	6716	New York	Cayuga	American fb.	Efb active Afb scales
9- 2-19	6721	Washington	Pacific	?	
9- 2-19	6722	Washington	Pacific	?	Efb more prominent
9-19-19	6768	California	Santa Barbara	?	Afb 1st disease reported for county
9-26-19	6778	California	Santa Barbara	?	
10- 5-19	6834	California	Santa Cruz	?	
5-12-20	6985	California	Butte	European fb.	Afb one or two cells
5-29-20	7023	Michigan	Calhoun	?	
5-29-20	7025	Michigan	Calhoun	?	
5-29-20	7026	Wisconsin	Fond du Lac	European fb.	Few cells Afb
6-17-20	7119	Washington	Lewis	?	
6-17-20	7120	Washington	Lewis	?	Also Sacbrood
6-22-20	7143	New York	Allegany	European fb.	Few cells Afb.
6-24-20	7158	Pennsylvania	Crawford	?	
6-26-20	7172	New York	Cayuga	?	
6-26-20	7174	New York	Cayuga	?	
6-26-20	7177	Pennsylvania	Crawford	?	
7-21-20	7335	New York	Seneca	Probably Afb.	
8- 5-20	7386	Indiana	Blackford	?	
8- 5-20	7387	Indiana	Blackford	?	

TABLE II.—SAMPLES OF MIXED INFECTION BY YEARS

Year	Samples of mixed infection	Total Samples received
1911	1	1042
1916	2	374
1917	1	449
1918	2	429
1919	18	693
1920	14	698
1905–1920	38	7568

This marked apparent increase in cases of mixed infection carries the subject over from one of scientific interest to one of practical importance. As is shown in Table III, the 38 samples of mixed infection have come from 24 counties in thirteen states, most of these located in prominent beekeeping regions. In eleven of these thirteen states both European foulbrood and American foulbrood as shown by samples of disease received in the laboratory for diagnosis are prevalent and of long standing. There are only about three or four other states where both diseases have been found in quantity from which samples of mixed infection have not been received, while only from two states of the many where the diseases are only occasionally bad have such samples been received.

TABLE III.—SAMPLES OF MIXED INFECTION BY STATES AND COUNTIES

State	Counties	Samples
California	5	12
Connecticut	1	1
Indiana	1	2
Iowa	1	1
Kansas	1	1
Michigan	1	2
Mississippi	1	1
Missouri	2	2
New York	3	5
Ohio	2	2
Pennsylvania	1	2
Wisconsin	2	3
Washington	2	4

Statistics obtained from the sample records, however, are not entirely conclusive since a majority of the samples come to the laboratory unsolicited. If a careful survey could be made of the regions where the brood diseases are bad and widespread, probably many more such cases would come to light.

TABLE IV.—DISTRIBUTION OF SAMPLES OF MIXED INFECTION BY MONTHS

April	5
May	9
June	10
July	1
August	6
September	5
October	1
November	1

These samples of mixed infection have been examined in eight out of the twelve months of the year, April to November inclusive, as shown in Table IV. Twenty-four of the total 38 samples, nearly 65 per cent., were examined during the months of April, May and June, the months during which European foulbrood is most prevalent.[3] In contrast to the spring months, eleven samples of mixed infection were examined during August and September, and only one each in July, October and November, a total of fourteen.

The question, however, of which diesase is most often the primary invader in a colony is difficult to answer, particularly without a history of the colony and locality. (Table I). If only dried adhesive American foulbrood scales are found, accompanied by numerous coiled fresh moist melting larvae of European foulbrood, it is not difficult to say that American foulbrood was the primary invader, perhaps during the previous season, as was the case of the sample reported by McCray. But often there is no such demarkation. Because the presence of American foulbrood depletes the strength of the colony this increases the probability of European foulbrood infection.

Since the requirements of the treatment of the two diseases are so entirely different, the necessity for correct diagnosis becomes of importance, particularly in regions where both diseases have been prevalent for some time. The presence of both diseases in the same colonies or even in the same apiary is a complicating factor in the diagnosis and treatment. Furthermore there is danger from the possibility of continued and confusing losses due to the ignorance of the presence of mixed infection in colonies under such circumstances and resulting therefrom, improper treatment which would only continue the losses.

Several samples have been received for diagnosis which beekeepers have thought contained both diseases and which indeed seemed to have some of the characteristics of each. Upon careful examination, however, both gross and microscopic, these have mostly proven to be definitely not mixed infections. The recognition of cases of mixed infection in

[3]Phillips, E. F., 1918. The control of European foulbrood. U. S. Dept. of Agric. Farmers' Bulletin 975, 16 pp.

colonies is often difficult because of the fact, as is particularly the case with European foulbrood, there are many irregularities and variations in symptoms that often add to the confusion of the beekeeper in making gross diagnosis hurriedly in the field. In order to more easily differentiate some of these confusing symptoms to assist in gross diagnosis, they may be divided into three classes. Occasionally in an unusually virulent case of American foulbrood or in one where the bees have deserted the brood because of its foul condition allowing what healthy brood there is to starve, larvae will be found which have died while still coiled in the cell, among the typical American foulbrood larvae.[4] These coiled larvae often have much the same appearance as typical European foulbrood coiled larvae. However, the consistency is generally quite different from European foulbrood, more like the typical slimy glue-like consistency of American foulbrood material. As a rule, however, the symptoms of American foulbrood are uniformly constant because of the fact that *Bacillus larvae* is almost always the only invader of the larvae causing death and a type of decomposition which prevents growth of other organisms. Several such cases were found in California.

A second class of confusing symptoms are found in samples which come particularly from regions where European foulbrood has been allowed to run unchecked for a long time. Such samples were found in certain sections of California and have been received from various other sections of the country. These samples show along with more or less of the typically coiled European foulbrood larvae, large numbers of larvae which have died after extending and even being sealed in the cell, showing a consistency somewhat like that of American foulbrood but more lumpy or like an old partly rotten rubber band.[5] Sometimes scales are found extended in the cells in such large numbers as to appear on casual examination like an old comb of American foulbrood. Close examination, however, shows the consistency, irregular shape and position with lack of adherence to the cell wall to be different from that in American foulbrood. This type was found to be quite prevalent in California.

The third class is composed of cases of actual mixed infection where typical American foulbrood, ropy larvae or scales, are associated in the same comb with typical European foulbrood, coiled moist melting larvae, or possibly occasionally the abnormal rubbery irregular larvae mentioned above. The active stage of the two diseases often seems to be localized more or less in different parts of the comb. This is probably due to

[4]White, G. F. 1920. American foulbrood. U. S. Dept. of Agric. Bul. No. 809.

[5]Sturtevant, A. P., 1920. A study of the behavior of colonies affected by European foulbrood of bees. U. S. Dept. of Agric. Bul. No. 804.

the fact that the queen would tend to desert that section of the comb containing the American foulbrood, particularly where this disease was the primary invader. In many cases one or the other of the diseases will be more prominent, at least in the active stages. This fact may be one of the causes for cases of mixed infection having been overlooked, the beekeeper seeing only the prominent outstanding symptoms. Therefore in cases where there is doubt or suspicion that both diseases may be present in the same colony, a positive laboratory diagnosis often appears to be desirable.

As is well known, the shaking method of treatment in its essentials is so far the only successful way of treating American foulbrood.[6] The nature of *Bacillus larvae* has prevented success along any other line, because of its ability to form exceedingly resistant spores and especially to decompose the dead larva in such a way as to cause the mass containing large numbers of these spores to adhere to the cell wall as if glued. It has been learned furthermore, often by sad experience, that the shaking treatment is practically never successful in the treatment of European foulbrood; in fact, often when used causes the disease to be spread all the more because of the weakening effect the shaking has on the colonies.[7] The requirements for the successful treatment of European foulbrood have been found to be fundamentally dependent upon adequately strengthening the colonies with young bees sufficiently to throw off the disease,[7] at the same time combined with the requeening of the diseased colonies with vigorous young Italian queens, permitting the bees themselves to remove the infected material.

The apparent logical solution of the problem of the treatment for a known case of mixed infection, therefore, is to combine the treatments for both American foulbrood and European foulbrood as a single treatment. In other words, the one or more colonies known or strongly suspected to have mixed infection should be shaken as for American foulbrood, requeening them with vigorous young Italian queens and later strengthening them by the addition of young bees or hatching brood from a healthy colony, or by uniting later. Strength of colony is the important factor combined with the shaking and requeening with vigorous Italian stock.

The problem of the control of mixed infections of American foulbrood and European foulbrood is primarily associated with the control of European foulbrood. In localities where both diseases are prevalent

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[6]Phillips, E. F. 1920. The control of American foulbrood. U. S. Dept. of Agric., Farmers' Bulletin No. 1084.

[7]Phillips, E. F. 1918. The control of European foulbrood. U. S. Dept. of Agric., Farmers' Bulletin No. 975.

and there is suspicion of both being present in the same apiary, and possibly even some as mixed infection in the same colony, control of the two diseases will depend upon the elimination of European foulbrood first. This should be done by treating the entire apiary for European foulbrood, by strengthening and requeening all the colonies with young and vigorous Italian queens, which is after all only good beekeeping. After the elimination of European foulbrood it will be a simple matter to determine those colonies that have not responded to this treatment, as being American foulbrood. This method is possible because of the fact that American foulbrood seldom spreads with the rapidity of European foulbrood, particularly if care is taken to prevent robbing and mixing up of combs. Those colonies which continue to show American foulbrood remaining may now be given the usual shaking treatment.

CHAIRMAN PADDOCK: The next part of the symposium is "The Future of Bee Disease Control" by E. F. Phillips of Washington, D. C. Inasmuch as Dr. Phillips is not present, but has sent his paper it will be published with those read by title.

CHAIRMAN PADDOCK: The next paper is by Professor H. F. Wilson.

MR. WILSON: The title of the paper should be "Spread and Control of American Foul Brood."

The spread and control of American foul brood is of evident importance as shown by the space it has taken in our bee journals. The problem is one that is not as serious as we have believed. The difficulty has been that not only the bee keepers but the investigators themselves did not thoroughly understand the spread and control of the disease, and only during the last two or three years has there been sufficient light on the subject to permit of a proper method of preventing the spread and securing the eradication of the disease.

SPREAD AND CONTROL OF AMERICAN FOUL BROOD

By H. F. WILSON, *Madison, Wisconsin*

(Withdrawn for publication elsewhere)

MR. WILSON: I might say that in Wisconsin there has been a great deal of discussion among the bee keepers as to whether or not they could use the old brood comb from diseased colonies, and this has been one of the means of carrying diseases on indefinitely.

The main point is that the bee keeper has not known and does not know what to do, and it is necessary for us to carry on our campaign of education in connection with the law in order to let the bee keeper know what he has to do.

CHAIRMAN PADDOCK: The importance of this subject commands careful consideration by this body and I hope you that will feel free to discuss this matter fully. I am sure that there are some here who have views that they might care to express.

MR. ROOT: There is one point that I can illustrate on the board of distinction between the two diseases. I think of all the states I have ever been in, in the United States, California has been diseased the worst. I do not think there is any possibliity of being mistaken on that point. They had one kind of Foul Brood that is very confusing there. It is a European Foul Brood in advanced stage. It looks so much like American that it is called American and they treated it for American but it did no good. We used to say that if any dead matter will rope out an inch or two inches, you can tell whether it is American or European. If it ropes out an inch or so, it is American. That rule does not apply.

CHAIRMAN PADDOCK: If there is no further discussion, we will proceed to the transaction of the business and under that heading I will ask Dr. S. B. Fracker to bring a matter to your attention.

DR. S. B. FRACKER: At the request of Mr. Kindig, the State Inspector and Apiarist of Michigan, the Apiary inspectors of the Mississippi Valley met at Chicago on December 6, 1920, discussing various facts of interest to bee keepers. Resolutions were passed on one topic. They were really in the form of an agreement between the inspectors.

Since coming to the meeting, the Chairman of this section and the Secretary have asked me to present an outline of the action taken and the reason therefor. The meeting was called primarily because of the transportation from one state to another in this territory of two apiaries into clean territory under an inspection certificate from the State of origin. The transportation naturally resulted in a certain amount of correspondence and apologies from the inspectors who personally examined the apiaries. In heavily infected territories, two or three colonies were found diseased and destroyed, the remainder of the apiary was given a certificate of inspection and freedom from diseases. The apiary was transported into another state into clean territory and the diseases were introduced. In one case, at least, the territory had been cleaned at great expense through an apiary cleanup campaign, and not a single case was known in the territory at that time, although they had had diseases before.

The result was that the following agreement was reached:

RESOLVED, That the undersigned apiary inspectors of the North Central States and Canada believe and agree that inspection certificates for the inter-state transportation of bees and used apiary supplies should be given only to apiaries which have never been infected or which have been free from American Foul Brood for at least one year.

Provided, however, that bees newly shaken on foundation under the supervision of an inspector, or bees in combless packages supplied with food made from pure sugar only are exempted from the provisions of this section.

It is further agreed that whenever a case of the inter-state transportation of bees or used bee supplies with or without an inspection certificate comes to the attention of one of the undersigned, full information will be sent to the state inspector of the state of destination.

The inspectors meeting together were:

B. K. Kindig, R. H. Kelty, P. T., Ullman, East Lansing, Michigan; S. B. Fracker, H. L. McMurry, State Capitol, Madison, Wis.; C. D. Blaker, Minneapolis, Minn.; F. B. Paddock, Ames, Iowa; A. L. Kildow, Putnam, Ill.; F. N. Wallace, C. O. Yost, Indianapolis, Ind.; E. C. Cotton, Columbus, Ohio; C. L. Hershiser, Kenmore, New York; F. Eric Millen, Guelph, Canada.

The following also met with the inspectors:

J. C. Henager, Salt Lake City, Utah, representing the state apiary inspector of Utah; H. B. Parks, San Antonio, Texas; B. J. Kleinhesselik of Hardin, Montana; and E. Ewell, Ypsilanti, Michigan.

It was suggested at that time that the matter be brought to the attention of this body. I believe, however, that the section has no Committee on Resolutions. As this represents a body covering the entire United States, it may be that the resolutions as they are worded are not entirely applicable to or do not represent the sense of this body. However, one question which was taken up at that time and which can be brought before this body is that of stricter regulation on inter-state transportation of bees and used bee supplies. At present the only regulations there are apply to postal shipments. There are no inter-state regulations applying to freight or express, and the postal regulations are that packages of bees or used bee supplies shall have attached to them either an inspection certificate or sworn statement that the honey used in preparing the food in the case of combless packages was boiled half an hour, I believe it is.

It has recently come to our attention that this statement from the shipper is practically of no value owing to the habit of a large number of southern bee keepers using these certificates carelessly, and we have very good information indicating that it is not the practice to boil the honey at all in spite of the fact that this certificate is attached.

The second form of information that is in our hands is the secondary use of these statements. There is no requirement of the signer of the

certificate to the effect that the honey has been boiled by the shipper, consequently large numbers of these printed tags have been sent to certain apiaries and they have been carelessly attached to any shipment that it was convenient to make.

Is a motion in the form of a resolution along these lines in order?

CHAIRMAN PADDOCK: There is a general Resolutions Committee of the Association. I would like to know the pleasure of this body concerning this matter. You have heard the resolution and the information from the gathering on the 6th of December. Some of these parties are here tonight. What is the pleasure of this Section relative to this matter?

MP. BALL: I move you that the Chair appoint a Committee of three to take this up and prepare a general resolution to embody the idea, with the part in regard to the permission to ship bees that have been infected with American Foul Brood eliminated, and that we adopt that now, giving the Committee power to reconstruct it so as to be acceptable with that provision eliminated.

D. Ball's motion was seconded and carried.

CHAIRMAN PADDOCK: I will appoint on that Committee Dr. Ball, Mr. Cotton and Dr. Fracker. It is the understanding that the action of that Committee will bind this Section.

CHAIRMAN PADDOCK: Is there any other matter to be brought before this Section in its business session?

MR FRACKER: Would it be in order to move that the matter of making recommendations on legislation for Federal regulation of inter-state transportation of bees be also referred to this same Committee?

CHAIRMAN PADDOCK: I think it should, with power to act. If there are no further items of business, we will hear the report of the Nominating Committee.

MR. F. C. PELLETT: Mr. Chairman, your Committee begs leave to recommend for Chairman for the coming year, Prof. H. F. Wilson of Wisconsin; for Secretary, our present incumbent, Prof. G. M. Bentley.

CHAIRMAN PADDOCK: What is your pleasure in regard to the report of the Nominating Committee?

MR. PELLETT: I move the adoption of the report.

The motion was seconded and carried unanimously.

Adjournment.

EXPERIMENTS WITH GRASSHOPPER BAITS[1]

By J. R. PARKER and H. L. SEAMANS, *Bozeman, Mont.*

During the summer of 1919 preliminary experiments were conducted for the purpose of improving the efficiency and reducing the cost of the poison bran mash commonly used for grasshoppers, special attention being given to finding substitutes for the lemons and oranges generally recommended to make the mash attractive. While the tests were not extensive enough to warrant the drawing of any general conclusions, certain materials appeared so promising that a report is given at this time in the hope that other workers will try them out during the present season.[2]

MATERIALS TRIED AS SUBSTITUTES FOR CITRUS FRUITS

The following materials were used in place of oranges or lemons in the standard formula: amyl acetate, vanilla extract, lemon extract, vinegar, watermelon, cantaloupe, banana, and ground apples. As checks in all experiments, the poison bran mash was tried with salt and molasses only, and with salt alone. Equivalents were used on the basis of one lemon being equivalent to any one of the following amounts:

1. 2 teaspoonsful of 4 per cent. lemon extract
2. 2 teaspoonsful of vanilla extract
3. 2 teaspoonsful of vinegar
4. 1 teaspoonful of amyl acetate
5. 1 orange
6. 1 apple
7. 100 grams banana
8. 100 grams cantaloupe
9. 100 grams watermelon

The various baits were prepared according to the following formula:

Bran	25 lbs.
Paris green	1 lb.
Salt	1 lb.
Molasses	2 qts
Lemon or equivalents	12 units
Water	10 quarts

[1]Contributed from the Entomological Laboratories of the Montana State College.

[2]Since this paper was submitted for publication in April, 1920, we have had an excellent chance to try out amyl acetate on a large scale, 12,300 ounces having been used during the summer of 1920 in a severe grasshopper outbreak. County Agents and farmers having once tried the amyl acetate flavored poisoned bran mash would use nothing else. It was very effective and the campaign was the most successful we have ever conducted. The use of amyl acetate as a substitute for lemons in this one campaign saved at least $2,000 in the cost of materials, reduced the labor necessary in mixing the poisoned bran mash, and increased its effectiveness.

Since the experiments were conducted primarily to determine the relative value of the various flavoring materials, they were used at the strength recommended for immature grasshoppers, i. e., twice as strong as when used against adults. This was done so that each kind of bait would have a strong distinctive odor of its own.

Method of Putting Out Baits

In the first experiments the various baits were scattered on boards and over small plats in areas 30 yards apart where grasshoppers appeared to be uniformly distributed. The number of grasshoppers feeding at each board was recorded every twenty minutes and counts of dead grasshoppers were made on the plots at the end of two days. This method did not prove satisfactory as it was observed that the grasshoppers moved about during the day and that their distribution was by no means uniform or constant. In other words, the scarcity or abundance of grasshoppers in the vicinity of any particular bait had a much greater bearing on the results than did the relative attractiveness of the bait itself.

Where observations are made every twenty minutes there is too great an element of chance for satisfactory results. At the particular moment the observation is taken the grasshoppers may have momentarily ceased feeding because of a passing cloud or gust of wind, while a few minutes before they may have been feeding very heavily. The results of the first experiments were so variable that they were not reported. However, it should be stated that in practically every test amyl acetate was far ahead of all the others that were tried.

In order to overcome the question of uneven distribution and the element of chance in making observations, it was decided to conduct all tests at one point and have them under continuous observation. Each kind of poison bran mash was placed in a small tin pan six inches in diameter and one inch deep. The pans were arranged in a three foot circle where adults of *Camnula pellucida* Scudd. had gathered in large numbers for breeding, and egg laying. An observer stationed ten feet from the pans watched with field glass and recorded every grasshopper that climbed into a pan and actually fed. The relative position of the pans in the circle was changed and fresh bait was put out every two hours. All of the experiments reported on were conducted in this way.

Results of Experiments

Experiments were conducted on August 4, 6, and 7, during which time 2074 grasshoppers climbed into the pans and registered their choice.

TABLE I.—SHOWING THE NUMBER OF GRASSHOPPERS FEEDING DAILY AT VARIOUSLY FLAVORED POISONED BAITS

Attractive Element	August 4		August 6		August 7		Total Number Feeding	Final Rank
	Rank	Number Feeding	Rank	Number Feeding	Rank	Number Feeding		
Amyl acetate	1	49	1	166	1	164	379	1
Vanilla	8	10	2	127	2	105	242	2
Watermelon	2	33	3	96	11	47	174	3
Molasses and salt only	9	8	4	78	6	69	157	4
Salt only	10	7	5	76	5	74	157	
Oranges	3	18	6	75	9	59	152	5
Apples	7	11	8	72	7	69	152	
Cantaloupe	4	18	11	50	4	78	146	6
Vinegar	6	13	9	61	3	79	143	7
Bananas	5	18	10	55	10	57	135	8
Lemons	11	7	7	75	12	44	126	9
Lemon extract	12	6	12	42	8	63	111	10

CONCLUSIONS

1. Amyl acetate was decidedly the best of all the attractive materials used, ranking first in every test and attracting far more grasshoppers than any other bait. The use of amyl acetate in grasshopper baits was first suggested by Professor R. A. Cooley in 1918 and was tried in one experiment with promising results during that season. Our results with it in tests conducted this year lead us to believe that it is a most promising substitute for citrus fruits in the standard poison bran mash bait for grasshoppers. Amyl acetate is not only the most attractive of the materials tried out but is also the cheapest of those that ranked high in attractiveness. An ounce costs five cents and is equal to eight lemons or oranges. It also has the additional advantage of being ready to add to the poison bran mash without cutting or grinding, it is so concentrated that it is easy to transport, and it will keep indefinitely.

2. Vanilla ranked second in the list of attractive materials and with amyl acetate was far better than any of the other materials tried. Its present cost is such that it cannot be used economically in grasshopper baits.

3. Of the fresh fruits used, watermelon gave the best results but it was no where near as attractive as amyl acetate or vanilla and was little better than salt alone.

4. One of the surprising results of the experiments was that salt alone gave just as good results as when molasses and salt were used and that both gave better results than when lemons or oranges were added. This is of considerable interest because it indicates that excellent results may be obtained even when it is impossible to secure molasses or citrus fruits, as sometimes happens. If this point can be established by further experiments, it means that thousands of dollars have been wasted in the useless purchase of molasses and citrus fruits. It will also mean that in the future farmers will more readily use grasshopper baits because of decreased cost and labor in the preparation. It should

be noted here that Morrill[1] and Ricker[2] have shown that molasses is not necessary against cutworms and several species of grasshoppers.

5. It was found that lemons, which have been widely recommended as the attractive element in grasshopper baits, were the least attractive of all the materials tried with the exception of lemon extract. Oranges gave better results than lemons, ranking fifth, while lemons ranked tenth.

6. It should be borne in mind that the tests were concerned with adults of only one species of grasshoppers, *Camnula pellucida* Scudd., which had gathered in great numbers for breeding and egg laying. The writers wish it distinctly understood that they consider the experiments too limited and the conditions too abnormal for the drawing of definite conclusions or to warrant the radical changing of methods in preparing grasshopper baits. The results of the tests are given merely to suggest materials that may in the future prove more effective and cheaper than those now in use.

Scientific Notes

Imported Pine Sawfly. Larvae of *Diprion simile* were collected at Harrisburg, Pa., on September 13, 1920, by F. M. Trimble and T. L. Guyton, Assistant Entomologists with this Bureau. Adults were reared and identification verified by Mr. S. A. Rohwer. This, I believe, is a western record for Pennsylvania.

J. G. SANDERS

Salt Marsh Mosquitoes Far Inland. In the course of the mosquito survey of southern Illinois conducted by the Illinois Natural History Survey, two salt marsh species have been discovered. *Anopheles crucians* Wied. was reared from a pond at Herrin in September 1920, and *Aedes sollicitans* (Walker) D & K was taken once at Carbondale in March 1918, and several times in considerable numbers in May 1920 at Herrin. Identifications of these species were kindly confirmed by Dr. Dyar.

Although apparently far from their natural habitat, it is possible that they are living under conditions approximating the sea coast, since this section is underlaid with salt, as witnessed by the occasional salt springs and salt outcroppings.

S. C. CHANDLER
Field Entomologist for Southern Illinois

The Thuberia or Wild Cotton Boll Weevil. (*Anthonomus grandis* var. *thurberiae* Pierce) has made its appearance in cotton fields near Tucson, Arizona. In 1914, this insect was found by Mr. B. R. Coad of the U. S. Bureau of Entomology, infesting experimental plots of cultivated cotton in the foothills in a location recognized as especially favorable for such infestation to occur but the insect has not previous to 1920 been found attacking commercial plantings. Although not unexpected to those acquainted with the wild cotton situation in Arizona, and the abnormal conditions which have existed during the past season, the actual discovery of the weevil in Arizona cotton fields marks a notable event in the history of cotton culture in the arid Southwest.

A. W. MORRILL

[1]JOUR. ECON. ENT., Vol. 12, No. 4, p. 337.
[2]JOUR. ECON. ENT., Vol. 12, No. 2, p. 194.

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

FEBRUARY, 1921

The editors will thankfully receive news items and other matter likely to be of interest to subscribers. Papers will be published as far as possible, in the order of reception. All extended contributions, at least, should be in the hands of the editor the first of the month preceeding publication. Contributors are requested to supply electrotypes for the larger illustrations as far as possible. Photoengravings may be obtained by authors at cost. The receipt of all papers will be acknowledged.—EDS.

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The second annual dinner, like the first, was a most pleasant and popular affair, a very desirable change from the more serious regular sessions. The editor is but voicing a general sentiment when he congratulates the originator upon his happy thought and compliments him and his associates upon the admirable manner in which it was executed.

The Thirty-third Annual Meeting has passed and proved to be a well attended and highly successful gathering. The broader entomological problems received considerable attention as well as many of the more restricted and special interests. The joint session with the Plant Pathologists on dusting made possible an admirably broad summation of the questions involved by representatives of both organizations from different parts of the country. The comparatively innocent appearing title: "The Spreading of Sprays" opened a vista into closely related problems having a most practical bearing on economic entomology. It was typical of a number of cases where entomologists need close and long sustained co-operation from investigators along other lines if the best results are to be obtained without great delay. The difficulty of securing team work of this character was an important factor in the organization of the Crop Protection Institute, an organization which has among its possibilities a profound modification of the investigational work of the country.

The great delay in mailing the December issue was unanticipated and due to a very unusual combination of circumstances. The editor was in hopes the issue would be in the hands of most members a week before it was necessary to leave for the annual meeting. Particular attention is called to the editorial of that number because it summarizes present conditions and outlines the policy recently adopted.

Current Notes

Conducted by Associate Editor

The Illinois State Beekeepers Association held its annual meeting at the Leland Hotel, Springfield, on December 14 and 15.

The Tennessee State Beekeepers Association held its annual convention at Nashville, Tennessee, on January 27, 1921.

Dr. J. M. Aldrich was elected president of the Entomological Society of America at the Chicago meeting.

The annual meeting of the Minnesota State Beekeepers Association was held at Minneapolis on December 7 and 8.

Mr. H. P. K. Agersborg has been appointed assistant in zoology and parasitology at the University of Wyoming.

Doctor S. B. Fracker, acting State Entomologist of Wisconsin, was appointed State Entomologist, to take effect July 1, 1920.

Mr. R. D. Olmstead, assistant in entomology at the New York (Geneva) Agricultural Experiment Station, resigned October 1st, 1920.

The Thirty-second annual meeting of the California State Beekeepers Association will be held at Oakland, March 1–4, 1921.

Professor W. C. O'Kane is chairman of the Crop Protection Institute organized recently under the auspices of the National Research Council.

The annual meeting of the Chicago-Northwestern Beekeepers Association was held in the Great Northern Hotel, Chicago, December 6 and 7.

Mr. J. C. Holton, formerly with the State Plant Board of Florida, is now in charge of the sweet potato inspection service in Mississippi.

Mr. George F. Arnold has resigned his position with the Federal Horticultural Board to accept a position as assistant entomologist with the State Plant Board of Mississippi.

Doctor T. J. Headlee gave an address on Mosquito Control at a luncheon of the Chamber of Commerce at Hotel Taft, New Haven, Connecticut, December 18, 1920.

Mr. J. G. Hester has resigned his position with the Federal Horticultural Board to accept a position as assistant entomologist with the State Plant Board of Mississippi.

Announcement was made of a joint meeting of the Washington State Beekeepers Association and the Inland Empire Beekeepers Association, held at Spokane, Washington, December 14, 15 and 16.

Mr. H. L. Dozier spent the past year in the Graduate School of Ohio State University, and is now assistant entomologist for the State Plant Board of Mississippi.

Doctor F. C. Craighead of the Bureau of Entomology, Washington, D. C., has been appointed entomologist in the Division of Forest Insects, Entomological Branch, Canadain Department of Agriculture.

Mr. E. W. Stafford, Assistant Professor of Zoology and Entomology in the Mississippi A. & M. College, was in the Graduate School of Cornell University, during the past summer.

Doctor A. E. Cameron, Saskatoon, Saskatchewan, and A. B. Baird, Fredericton, N. B., have been granted a six months leave of absence from the Entomological Branch, Canadian Department of Agriculture.

Miss Gladys Hoke is continuing her work on scale insects in Mississippi. She spent several months early in the year studying with Doctor A. D. MacGillivray at the University of Illinois.

The annual meeting of the Pennsylvania Beekeepers Association was held at Harrisburg, January 26, during Farmers' Week. Doctor E. F. Phillips was on the program as one of the speakers.

Mr. Eli K. Bynum, formerly with the State Plant Board of Florida, is now located at Ocean Springs, Mississippi, where he is employed as an inspector for the State Plant Board of Mississippi.

Prof. H. Okamoto, formerly of the department of entomology of the Hokkaido Agricultural Experiment Station, Sapporo, Japan, is now entomologist of the agricultural experiment station at Suigen, Corea.

Prof. Saturo Kuwayama has been appointed entomologist of the Hokkaido agricultural experiment station, Sapporo, Japan.

According to *Science*, Professor Clarence E. Mickel, Extension Entomologist, College of Agriculture, University of Nebraska, has resigned to accept a position as research entomologist with the American Beet Sugar Company, Rocky Ford, Colorado.

Mr. F. M. Hull has returned to continue his studies at the Mississippi A. & M. College. He was employed during the past summer at the Japanese Beetle Laboratory at Riverton, New Jersey.

Mr. P. R. Myers of the Bureau of Entomology, has been placed in charge of the field laboratory at Carlisle, Pa., to fill the vacancy caused by the death of Mr. W. R. McConnell.

The New Jersey Beekeepers Association held its annual meeting at Trenton on January 13 and 14, 1921. The program was arranged by the Secretary, E. G. Carr, New Egypt, N. J.

Doctor M. W. Blackman has returned to take up his work as Professor of Forest Entomology at Syracuse University, after spending eight months in Mississippi, studying forest insects for the State Plant Board of Mississippi.

Resignations from the State Plant Board and Entomological staff in Mississippi since July 1, 1920, have been as follows: R. L. Howell, W. H. Carpenter, E. G. Wade, J. F. Scoggin and B. L. Collins.

A three days annual meeting of the Michigan Beekeepers Association has been planned for January 25, 26 and 27 at East Lansing, probably at the Agricultural College. Mr. R. H. Kelly, East Lansing, is the secretary.

Imperial Bureau of Entomology. The publication office is now at 41, Queen's Gate, London, S. W. 7. Send all communications respecting subscriptions or exchanges for the Review of Applied Entomology and the Bulletin of Entomological Research or to the Bureau Library, to the Assistant Director at the above address.

The Florida State Beekeepers Association was organized at Gainesville, October 6, about 65 being present. The following officers were elected: J. W. Barney, presi-

dent; J. K. Isabel, vice-president; J. R. Hunter, secretary, and K. E. Bragdon, treasurer.

According to *Gleanings in Bee Culture*, Mr. H. B. Parks resigned as State Apiarist of Texas on November 1, to take up his new work in the sales promotion and extension department of the Texas Honey Producers Association.

Resignations from the Entomological Branch, Canadian Department of Agriculture, are announced as follows: G. M. McFarlane, Saskatoon Laboratory; E. P. Donat, Annapolis Laboratory; G. H. Hammond, Division of Field Crop and Garden Insects; Miss M. M. Nash, stenographer, headquarters.

The following resignations from the Bureau of Entomology have been announced: Joseph N. Crister and J. C. Woolley, Southern field crop investigations; George S. Demuth and E. Watkins, Apicultural Investigations; C. A. Bennett, Tropical and Subtropical Fruit Insect Investigations.

It has been announced that the Ohio State University gave a short course for beekeepers January 31 to February 5. Doctor E. F. Phillips of Washington, D. C., was in charge. Mr. George S. Demuth was also one of the speakers.

Mr. W. R. Thompson of the Bureau of Entomology who is now in southern Europe collecting insect parasites of the European corn borer, reports encouraging progress. Several hundred Hymenopterous parasites have already been shipped to Boston and arrived in excellent condition.

Professor J. G. Sanders, Director of the Bureau of Plant Industry, Pennsylvania Department of Agriculture, Harrisburg, Pa., is the official entomologist of a scientific expedition sent by the Everhart Museum, Scranton, Pa., to Panama. He plans to spend two months in the field.

The Chancellor's 28th biennial report of the University of Kansas shows the growth of the entomological department of that institution. In 1915–16 there were three instructors and 153 students; at present there are 337 students, though the number of instructors remains the same. In the same period the number of student hours has increased from 475 to 1405, an increase of 196 per cent.

Mr. R. N. Lobdell, Associate Professor of Zoology and Entomology at the Mississippi A. & M. College, addressed, by invitation, the Southern Nurserymen's Association at Charleston, South Carolina, on August 19, 1920, and the Tennessee Florists' Association at Memphis, Tennessee, on November 17, 1920.

Mr. F. H. Benjamin, Assistant Entomologist for the State Plant Board of Mississippi, has returned to Ithaca, New York, to continue his studies in the Graduate School of Cornell University, and is planning to return to Mississippi in February. He is devoting his entire time to Lepidoptera.

Mr. H. A. Scullen, formerly special field agent in beekeeping extension work for the State of Washington, has recently been appointed in charge of bee culture work at the Oregon Agricultural College at Corvallis, Oregon, and will have charge of the class work as well as extension work in Oregon.

Mr. J. L. King of the Pennsylvania Bureau of Plant Industry has been appointed specialist in insect parasites in the Federal Bureau of Entomology and has been sent to Japan to assist Mr. C. P. Clausen in collecting and rearing parasites of the Japanese beetle for introduction into New Jersey.

Mr. A. C. Burrill, special field agent of the Bureau of Entomology, who has been engaged in North Dakota, where for three years he has conducted the most extensive grasshopper campaign that this country has ever seen, has resigned to accept the position of Extension Entomologist at the University of Missouri, Columbia, Mo.

Mr. H. W. Allen, formerly with the U. S. Bureau of Entomology, came to Mississippi last June to accept a position as Assistant Entomologist with the State Plant Board. He has recently been transferred to the Entomology Department of the Mississippi A. & M. College, and is now devoting the greater part of his time to teaching.

A report of the proceedings of the meeting of the Association of Cotton States Entomologists held at Vicksburg, Miss., and Tallulah, La., March 1–3, 1920 (see this JOURNAL, Vol. 13, pages 256, April 1920) has been prepared in mimeograph form, and may be obtained by sending one dollar ($1.00) to A. F. Conradi, Secretary, Clemson College, S. C.

Mr. Oliver I. Snapp, for the past three years representing the Division of Deciduous Fruit Insects of the U. S. Bureau of Entomology in extension and investigation work in Mississippi with headquarters at Agricultural College, Mississippi, has been transferred to Fort Valley, Georgia, where he is in charge of the Bureau of Entomology Laboratory. His work will be almost entirely on peach insects.

Mr. P. H. Rolfs has severed his connection as director of the extension work in Florida on the 31st of December. After the first of January 1921 his address will be Bello Horizonte, Estado Minas Geraes, Brazil, where he is commissioned to locate, establish and conduct an agricultural institution of research and instruction. The President of Minas Geraes desires that the heads of departments shall be American scientists.

Mr. L. S. McLaine of the Entomological Branch, Canadian Department of Agriculture, spent two weeks in October in company with Mr. H. L. McIntyre of the Federal Bureau of Entomology, in northern New Hampshire, Vermont and the Maritime Provinces, examining the territory liable to soon become infested with the gipsy moth which is now in Maine and New Hampshire, only about twenty-five miles from the Canadian border.

A second conference in regard to the Mexican Bean Beetle was held at Birmingham, Alabama, on October 19, 1920. Among those in attendance were Doctor C. L. Marlatt, Chairman, and Doctor K. F. Kellerman of the Federal Horticultural Board; Professor Wilmon Newell of Florida; A. C. Lewis of Georgia; R. W. Harned of Mississippi; C. H. Popenoe and J. E. Graf of the U. S. Bureau of Entomology.

The annual meetings of the Ontario Entomological Society were held at Guelph November 17 and 18, with Mr. Arthur Gibson, President, in the chair. The following entomologists were present from the United States: Doctor E. P. Felt, State Entomologist, Albany, N. Y.; Professor C. R. Crosby, Cornell University, Ithaca, N. Y.; Mr. W. R. Walton, Washington, D. C., and Mr. L. H. Worthley, Boston, Mass., of the Federal Bureau of Entomology.

According to the *Experiment Station Record*, the division of entomology of the University of California has been reorganized as the division of entomology and parasitology. Professor W. B. Herms has been appointed head of the division, continuing his activities in parasitology, practical medical entomology, and ecology. The division is made up of three groups, viz. general entomology and taxonomy, agri-

cultural entomology, and parasitology, in relation to animal industries, in charge respectively, of E. C. Van Dyke, E. O. Essig, and S. B. Freeborn.

Mr. Frank Pellett of Hamilton, Illinois, and Professor H. F. Wilson of the University of Wisconsin, spent a week from August 30th to September 4th, 1920, in Mississippi, where they addressed enthusiastic meetings of beekeepers at Greenville, on August 31st, Agricultural College on September 2d, and Gulfport on September 4th. They were investigating beekeeping conditions in Mississippi. These meetings had been arranged by Specialists in Bee Culture, R. B. Wilson, and Entomologist, R. W. Harned.

On September 7th and 8th, a collecting and scouting party spent two days collecting on Cat Island off the Gulf Coast of Mississippi. The party included T. S. Van Aller and W. C. Dukes of Mobile, Alabama, Doctor L. E. Miles, H. H. Kimball, H. L. Dozier, F. H. Benjamin, R. P. Barnhart, and R. W. Harned of the Entomological and Plant Board Staff in Mississippi, and J. E. Graf of the U. S. Bureau of Entomology.

Extensive Argentine Ant control compaigns have been put on at the following towns in Mississippi: Woodville, Crystal Springs, Durant, Starkville, and Laurel. This work is done in co-operation with the State Plant Board and the town authorities. Most of the work has been done under the direct supervision of Mr. E. R. Barber, of the U. S. Bureau of Entomology, assisted by Mr. Luther Brown, formerly of the State Plant Board of Florida, but now employed in Mississippi.

Mr. A. W. Morrill, formerly Arizona State Entomologist, has been located in Los Angeles, Cal., during the past year where he is managing entomologist of the Southwestern Alfalfa and Cotton Protective Service, a co-operative association of about twenty growers associations, extensive land owners, and business concerns having important interests in protection against alfalfa and cotton pests in the southwest, particularly against the alfalfa weevil, cotton boll weevil, Thurberia or wild cotton boll weevil and the pink bollworm.

Appointments to the Bureau of Entomology are announced as follows: W. A. Baker, Scientific Assistant, San Antonio, Tex.; R. C. Shannon, temporarily, Cereal and Forage Crop Investigations; James Zetek (part time) Panama project; R. E. Nolen, Camphor thrips, Satsuma, Fla.; Robert P. Colmer, James M. Langston, George F. Riley, J. B. Swift, Clifford G. Wallace, Joseph G. Hester, Jackson V. Vernon, George B. Ray, George L. Lott and Malcolm H. Mabry, all collaborators, Truck Crop Insect Investigations, under the direction of Professor R. W. Harned, Agricultural College, Mississippi.

The last legislature appropriated a total of $240,500 for the support of the State Plant Board of Mississippi. Among the chief activities of the Plant Board at this time are the following: scouting for the pink bollworm of cotton, Mexican bean beetle, sweet potato weevil, Oriental fruit moth, alfalfa weevil, and citrus canker; eradication of sweet potato weevil; eradication of citrus canker; Argentine Ant control; nursery inspection service; sweet potato inspection service; cottony cushion scale control; port inspection; enforcing quarantines against various pests, especially the pink bollworm of cotton.

Announcement has been made of the following transfers in the Bureau of Entomology: Julian J. Culver, Fort Valley, Ga., to Vienna, Va.; E. R. Skellregg, Dover, Del., to Fort Valley, Ga.; J. W. Jones, Arlington, Mass., to Carlisle, Pa.; D. W. Jones, gipsy moth work, Melrose Highlands, Mass.; to corn borer work, Arlington,

Mass.; Neale F. Howard, Bowling Green, Ohio, to Birmingham, Ala.; Fred A. Johnston, Kingsville, Tex., to Nogales, Ariz.; Francis F. Bibby, K. P. Ewing, R. C. Gaines and G. L. Plyler, boll weevil force to Federal Horticultural Board; E. R. Van Leeuwen, Cornelia, Ga., and W. D. Whitcomb, Yakima, Wash., temporarily to Fort Valley, Ga.

An important conference in regard to the Mexican Bean Beetle, *Epilachna corrupta*, that has recently been introduced into Alabama and now occurs in 12 counties in that State was held at Birmingham and Montgomery, Alabama, on September 20 and 21, 1920. Among those in attendance were: Doctor W. E. Hinds, State Entomologist of Alabama; Professor G. E. Starcher, State Horticulturist of Alabama; Doctor J. H. Montgomery of the State Plant Board of Florida; Professor A. C. Lewis, State Entomologist of Georgia; T. H. Jones, Entomologist of the Louisiana Experiment Station; Professor R. W. Harned, State Entomologist of Mississippi; W. J. Baerg, State Entomologist of Arkansas; C. H. Popenoe and J. E. Graf of the U. S. Bureau of Entomology.

Dr. Wilmon Newell has accepted the positions of Director of the Agricultural Experiment Station, Dean of the College of Agriculture and Director of the Agricultural Extension Division—all connected with the University of Florida at Gainesville, Florida. The appointment became effective January 12th last. Dr. Newell has not relinquished the position of Plant Commissioner, which he has held for the past five and one-half years. On the contrary, Dr. Newell will, in addition to the new duties he has assumed, continue to direct the plant pest control work and the police and regulatory activities of the State Plant Board of Florida.

During the Chicago meetings of the A. A. E. E. an organization of extension workers was formed, with the object of enabling the extension workers in the various states to keep in closer touch with each other, to enable them to take advantage of newly-discovered control methods, and to make possible the more rapid dissemination of knowledge of insect outbreaks which might spread from one state to another. Mr. E. G. Kelly, Manhattan, Kansas, was elected chairman. All those interested in such an organization are asked to communicate with Mr. W. P. Flint, Secretary, Natural History Building, Urbana, Illinois.

The Federal Horticultural Board has sent out a warning to the effect that French fruit seedlings now arriving in the country are heavily infested with brown-tail moth nests. Thorough inspection is urged upon all directly or indirectly affected by the possible establishment of this pest in new localities. Experiments are now in progess at Boston, Mass., to determine the possibility of killing the hibernating larvae by vacuum fumigation. There have also been repeated findings on shipments of French seedlings of the White Tree Pierid, *Aporia crataegi*, the larvae of which are general feeders on the foliage of fruit and wild rosaceous plants and oak trees in Europe. Inasmuch as there is a possibility of confusing the nests of these two species, it is suggested, if there be any doubt of the identity of the species, that that material be forwarded to specialists for determination.

Mailed March 9, 1921